PUBLIC WORKS

An Engineering and Construction Journal

City County State

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Brain Teasers:

That Irish special problem, which we gave last month, cut down quite materially the number of correct replies. The unemployment problem wasn't so hard, and most everyone that tried that one got the correct answer. Among those sending in early and correct solutions to the St. Patrick's Day Special were: S. MacGregory, New York; F. M. Smith, Texas; V. H. Hoeg, Iowa; M. Scott, New York; Carolyn Wachter, Iowa; and Benjamin Eisner, New Jersey.

The solution requires too much space to reproduce here, but if anyone wishes it in detail, please write "Brain Teasers," care of Public Works, 310 East 45th St., N. Y. The answers are:

Superintendent, Flynn, age 30.
Timekeeper, Kelly, age 12.
Laborer, Riley, age 24.
Foreman, Leary, age 48.
Mechanic, Murphy, age 18.

Monkeyshines:

A piece of rope weighs 4 ounces per foot. It is passed over a pulley and on one end is suspended a weight and on the other end a monkey. The whole system is in equilibrium.

The weight of the monkey in pounds is equal to the age of the monkey's mother in years. The age of the monkey's mother added to the age of the monkey is four years. The monkey's mother is twice as old as the monkey was when the monkey's mother was half as old as the monkey will be when the monkey is three times as old as the monkey's mother was when the monkey's mother was three times as old as the monkey.

The weight of the rope or the weight at the end is half as much again as the difference in weight between the weight of the weight and the weight plus the weight of the monkey.

How Long Is the Rope?

The following was sent in by Mr. Mitchell Selligman of Arkansas. It's well worth trying: What number is it, if its last digit is removed, quadrupled and transposed to the front of the original number, the result will be 7 times the original number?

And a little one by Mr. Eisner: What is the largest number that can be expressed with only three digits. How many digits in the number when written in the usual fashion?

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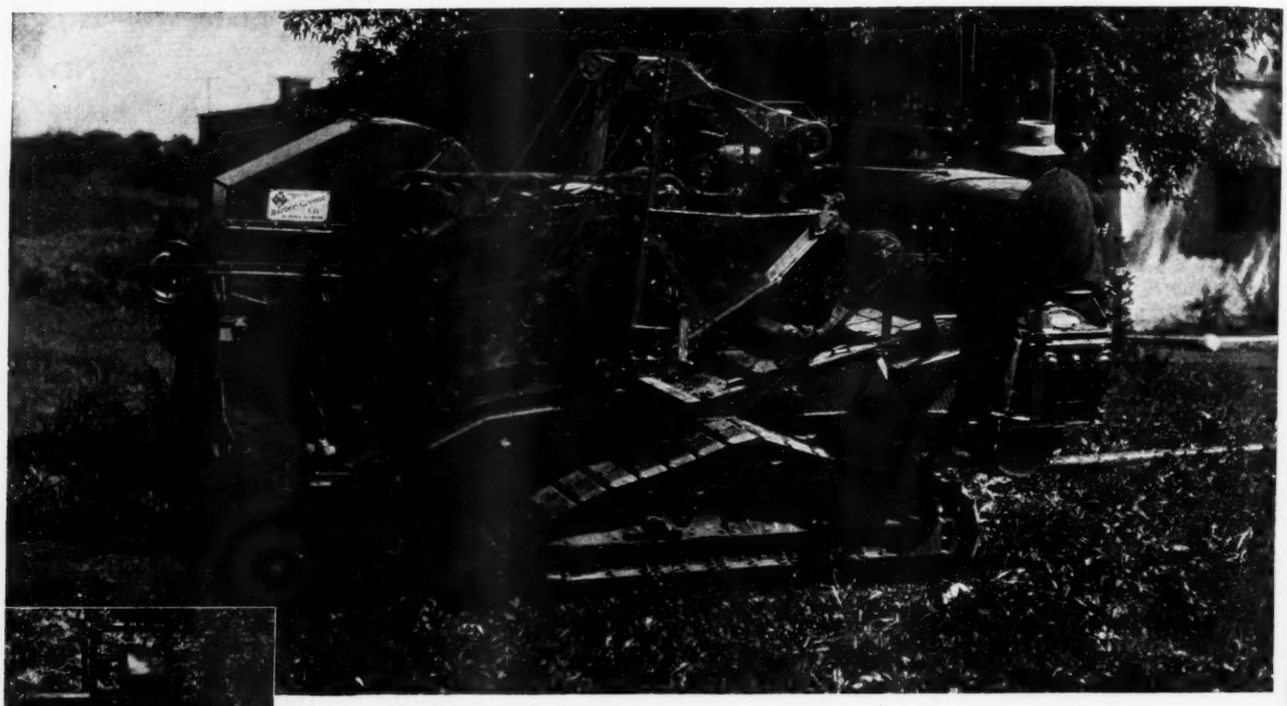
FOR THE WIDE OPEN SPACES OR THE TIGHTEST QUARTERS



THE Barber-Greene Utility Special Ditcher (above) can cruise at top speed through the wide open spaces, or, by offsetting the vertical boom, can cut a trench that practically grazes walks and shrubbery as shown in the left photo. It digs from 0 to 5' 6" deep and from 8" to 18" wide. It is the ideal machine for all work within its size range.

The Barber-Greene Service Special (below) is 48" wide, weighs 8,500 pounds, and digs up to 14 feet per minute. It is quickly transported on the special B-G trailer, and soon pays for itself either on cross country work or on short scattered jobs. This machine cuts from 0 to 3'-6" deep and from 5" to 11" wide.

One Service Special cut 2,100 feet in 7 hours, through clay and heavy shale with 5" of frost. Another made 2,235 feet digging maximum depth and width through an old gravel road at 7c per foot. Still another Service Special cut 1,000 feet of HOUSE CONNECTIONS by mid-afternoon and had to wait for the pipe gang.

You should have complete information on these machines. A line from you will bring it. No obligation.

DITCHERS LOADERS
CONVEYORS
COAL HANDLERS

4

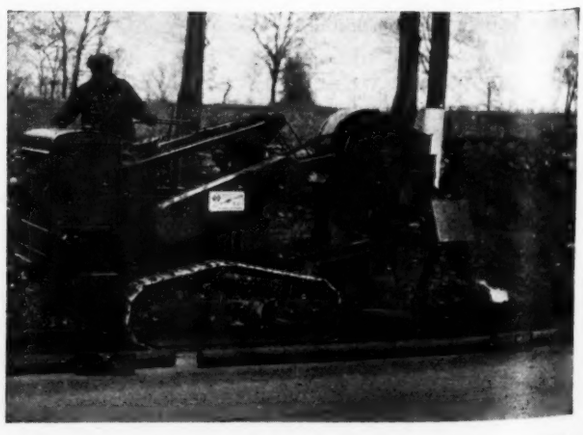
DIFFERENT

MODELS

Standardized Material Handling Machines

BARBER GREENE

635 W. Park Avenue
Aurora, Illinois



For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 63

PUBLIC WORKS

CITY COUNTY STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 63 April, 1932 No. 4

Balanced Equipment for Dirt Moving

By C. A. Spears

LOOKING over many grading jobs in the last few months it is surprising to note the number of contractors whose equipment is of the finest as far as it goes, but is anything but well balanced to give efficient results.

A contractor's equipment is one of the best gauges of the amount and cost of the work he can do. This is one feature the contractor can well afford to watch closely, keeping in mind that no job can be handled efficiently unless the equipment on this job is properly balanced, no matter how good the equipment.

Caterpillar Tractors with McMillian Scrapers on Spring Valley Water Co. reservoir. Sixty Tractors with 5-yard, and Thirty's with 2½-yard Scrapers.

In studying this phase of a grading job you will often find a contractor using two or three tractor wagons on a haul of from 1,500 to 2,000 feet where there should be many more to balance the output of the elevating grader or shovel loading the material. Job analysis has proven that beyond from 300 to 400 feet there should be one hauling unit added for approximately every additional 350 to 450 feet length of haul when one wagon is being used. Where two wagons are being used in train with tractor this distance increases to approximately 650 to 800 feet, depending upon the capacity of the loading unit.

Good management in laying out a job to make the hauling units balance the output of the loading unit will produce more profit for the contractor than any one phase of his job.

There are several features to be considered in laying out a tractor hauling job:

First, the length of the average haul. It is necessary to balance your short and long hauls in order to keep your equipment functioning properly, to the end that all equipment will operate efficiently throughout the entire length of the job.

Second, proper set-up of the number of wagons to be pulled by the tractors. This is very important, as it has been proven by numerous time studies that up to and including hauls from seven hundred fifty to twelve hundred feet (depending on the speed of the tractor, the capacity of the loading unit, and the condition of the runway over which you are hauling) dirt can be moved more cheaply by a tractor with one wagon than with two or more wagons.

In laying out a hauling job, the contractor must bear in mind that on some jobs where he could haul two wagons at low speed, by cutting off one wagon he could haul this load at a much greater speed. Time studies on numerous construction jobs have proven that what is called "constant time" or "loading and dumping time" on short hauls is usually more than the hauling and returning time. This applies on hauls which are sometimes as long as twelve hundred feet, depending on the speed of the tractor and wagon, and has a direct bearing on the distance at which it is cheaper to use one wagon.

Cost of equipment, depreciation, and other fixed charges also have a bearing on these costs.

There are numerous jobs where a large percentage of the dirt is short haul. Here is where the large hydraulic scraper can save the contractor money, as a graph of the cost of moving dirt by scrapers and tractor wagons shows it cheaper to use the large scraper up to from three hundred to five hundred feet, depending on the cost and time necessary to load the wagons, the size of the scrapers, and speed of delivery on both the wagons and scrapers.

One outstanding example of unbalanced units on a grading job was observed on a project recently visited, where a contractor had a straight cut and fill job through rolling country, the haul running from noth-

ing to about two thousand feet. The entire job was being done with shovels loading into wagons hauled by "Caterpillar" tractors.

Reviewing the job, the equipment used was of the best, but was limited to wagons that only fit on long hauls and shovels that were only good for rough grading and loading—not a scraper or grader of any kind on the job, with the result:

First—the shovel was working about 70% efficiently, as they were forced to try to carry the finished grade with the shovel. This operation was slow, as no shovel is built for fine grade finishing. Hence, the shovel was a great deal of the time jockeying around attempting to finish the grade.

Second—the tractors and wagons were delivering the earth on hauls from nothing up to two thousand feet, where the haul up to four hundred feet could have been made much more cheaply with tractors and scrapers.

When loading with shovels, it is safe to estimate that every time the operator drops a dipper full of earth into the hauling unit, it is costing the contractor approximately six to eight cents, making short hauls prohibitive, as large scrapers can move earth more cheaply up to approximately three hundred fifty to five hundred feet, depending on the size scraper used; and wheel type up to approximately six hundred feet.

As a result of this job analysis, the recommendation was made that the contractor purchase tractors and scrapers to make the fill between the proper wagon haul, which is not less than four hundred feet, and the shovel. It was explained to him that by the use of this equipment he could work his shovel through the cuts, roughing it out without impairing the efficiency of his shovel by trying to finish with it. Enough earth was left to be taken out by the scrapers to make the fill up to the economical length of haul for this type of equipment. The earth loaded by the shovel was used on the long haul, moved by the wagons.

The results were:

First—the contractor found he increased the output of his shovel at least twenty-five per cent.

Second—he cut the cost of the earth on his long haul by increasing the yardage delivered.

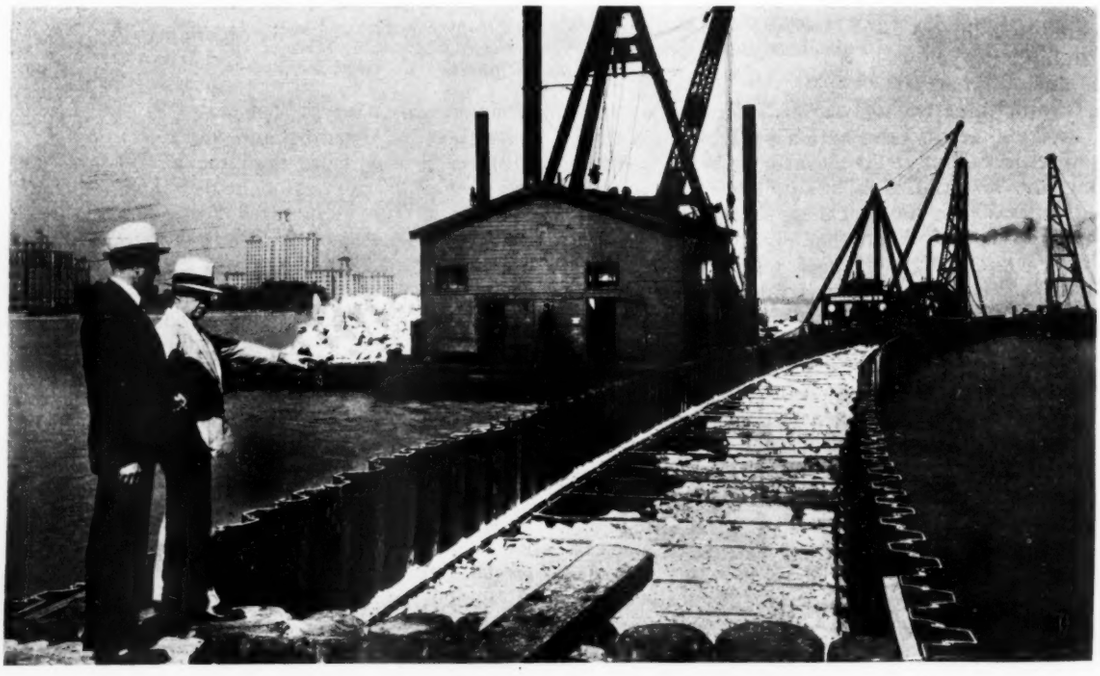
Third—he cut the cost of his earth on his short haul (which, by the way, was nearly one-third of the total yardage) to one-half the previous cost.

Fourth—he reduced his cost of finishing after the grading was roughed in to about one-third his original estimate.

There are many jobs where, by an analysis of equipment being used, contractors can materially decrease their costs. Many contractors try to make the job fit the equipment (which usually cannot be done), where, by a small additional investment, they can make the equipment fit the job and in some cases the saving will entirely cover the cost of the new equipment.

All-Steel Waling and Sheet Piling Used for Breakwater

The Great Lakes Dredge & Dock Company of Chicago, has just completed a new breakwater extending along the exposed lake shore from Margate Terrace to Foster Avenue in the new extension of Lincoln Park, Chicago. The breakwater is faced with No. ID 16-25 Inland steel sheet piling, and the waling is of Inland steel channels and bars. This is the first use of an all-steel construction of this nature on a location exposed to severe storms and choppy wave action. The officials of the company adopted this construction for this location because of stability of installation, speed and economy of construction, and long life.



Breakwater at Lincoln Park, Chicago, using steel channels

Some Suggestions for Locating Fire Hydrants

A subscriber has asked us to publish an article giving suggestions relative to the location of fire hydrants. The following is more or less elementary but may offer some help, especially to the younger engineers.

THE main purpose of a fire hydrant is to furnish water for fighting fires. It may be used also for flushing streets and sewers, filling sprinkling or flushing wagons, or other purposes; but these are only incidental and should be discouraged rather than encouraged, and should receive no consideration in planning hydrant location.

In some cities where water pressure is high, it is relied upon and pumpers are not used or are used only in the higher sections of the city and in the business section; but most cities use pumpers at all fires of any considerable magnitude.

No hydrant should take off from a pipe of less than 4 inches diameter, and 6 inches is the recommended minimum; and if a 4-inch main is used it should connect to a larger one not more than 500 feet from the hydrant in each direction, or 300 feet if it feeds the hydrant in only one direction.

Hydrants should be located at intervals of not more than 500 feet along every street that contains buildings or other fire possibilities. If the district is such that a fire might require more than eight streams in fighting it, 400 or even 300-foot intervals are desirable.

The location of a fire hydrant should be such that it will be as free as possible from accidents, such as being broken by trucks, but especially from damage by falling walls of a burning building. Also it should not be placed directly in front of a specially important fire risk or one likely to make it dangerously hot for the pumper and its engineers.

The hydrant should be so placed that it will offer the least inconvenience to pedestrians and others when it is not in use, but should be easily accessible and readily located at night in deep snow and under all other circumstances. It should detract as little as possible from the sightliness of the street.

When used in fighting fires, hose should have as few and as flat bends as possible; turning around a corner is undesirable. This is an argument in favor of corner location instead of the middle of the block.

From a hydrant located at a corner a straight line of hose can be extended out either street. Such a hydrant can be fed by the main in either street, whichever is the larger. It is more readily located at night and in deep snow, partly because the "center of the block" is not defined by any prominent physical features, and partly because there is generally a street light at the corner but not so often one near a mid-block hydrant.

A mid-block hydrant must generally be in front of some building, and may, especially in a business district, interfere with the use of passenger or delivery vehicles by the occupants of such building; or, in a commercial district, it is liable to be broken by trucks backing to the curb.

In some districts, especially the better-class residential, practically all the buildings may face on parallel main thoroughfares, in which case water mains would be unnecessary in the cross streets, except once every few blocks to furnish gridiron connections. It would therefore involve an otherwise unnecessary expense for mains to put fire hydrants in centers of the cross-street blocks. But in any given district all hydrants must be either at the corners or in the centers (or both, where the blocks are more than 500 feet long); they can not alternate from one to the other without introducing objectionable long intervals between them or expensively short ones.

Throughout any one city, or at least every considerable section, the location of hydrants should be uniform, to facilitate instant finding of them. It would be foolish to spend thousands of dollars on speed in fire pumpers so as to save two or three minutes in getting them to a fire, and then have them waste double this time trying to find the hydrants.

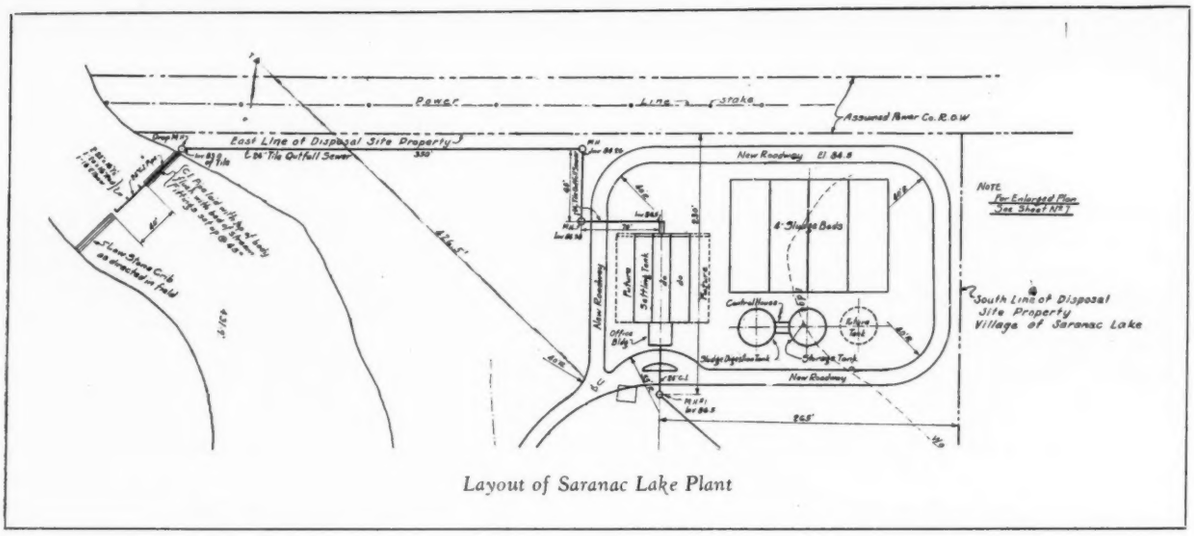
Objections to corner location are that it is generally occupied also by a light post or pole, and often by posts carrying electric wires, a letter box, or other structure which may make it more difficult to lay hose from hydrant to pumper or pumper to fire. Also it may be more apt to obstruct pedestrian traffic crossing the street. But both of these objections can be avoided by the city officials who locate, or grant permits to locate, these several poles.

Other arguments could be adduced, but the great majority and most important seem to favor the corner location.

For the exact location at a corner we recommend one which can be made uniform at all corners, can easily be designated and found, as well as being most serviceable. The last would generally require it to be taken off the larger main. To minimize obstruction to traffic it should not be in the pedestrian traffic lane either way. Therefore it should be either at the mid-point of the curb curve, or at or beyond the property line. With the long-radius curves becoming increasingly common, the former is inconvenient, conspicuous, and apt to be broken by hubs of trucks rounding the corner close to curb.

The property line of any street is generally indicated exactly by the fronts of buildings, fences or hedges, or at least edges of front lawns, and is therefore the location most easily found as well as indicated. We therefore recommend placing the hydrant at the curb, where the building line of the intersecting street, extended, cuts it. It should be a few inches back of the curb so that none of the nozzle caps will be hit by the wheels of vehicles passing close to the curb. There may be cases where a large tree or other object which it is not desirable to remove already occupies this spot. In such case the rule might be adopted of placing the hydrant just five feet from the nearest side of the tree.

Where the hydrant is in the center of a block (because it is more than 500 feet long), if there is an alley near this point it may be made the rule to place the hydrant 10 feet from the side line of the alley, on a unifom corner, such as the north-east (which is the warmest corner in most cases), adopted after a study of conditions throughout the city. If there is no alley, it may be placed always on the same side (as the north side) of the street, practically at the center of the block but the exact location subject to the considerations named above.



Layout of Saranac Lake Plant

Saranac Lake's Sewage Treatment Plant

By Henry W. Taylor
Consulting Engineer, New York City

A SEWER system has been in use in Saranac Lake, N. Y., for many years, raw sewage being discharged into the Saranac river, which river has a water shed area of 185 square miles above the sewer outlet. The minimum river flow, 5 second-feet per thousand population, did not furnish adequate dilution and a serious nuisance was created, the more intolerable because of the proximity of a main road which parallels the river for 7,000 feet, the excessive width and shallowness of the stream, and the formation of sludge deposits on the bed and shore line.

Solving the Problem

These conditions caused contention and complaint for nearly 20 years. In December 1930, the village officials, under the leadership of Mayor Hartley W. Taylor and City Manager Wayne E. Timmerman, retained the writer to study the problem. Plans were submitted which showed an estimated cost well within the capacity of the village to pay, and a contract for the work was signed in June by Mayor S. A. Miller and the plant was placed in operation on December 9, 1931.

Design Features

The sewage flow, as determined by weir measurement and checked by water consumption figures, averaged about 2 second-feet. The weir measurements were made in a dry season when ground water infiltration was at a minimum.

No location was available near the trunk sewer outlet for a treatment plant. A site was selected, therefore, some 7,000 feet further downstream, which had the additional advantage of being distant from a roadway or residential development.

The sewage treatment works consist of three settling tanks equipped with parallel sludge collectors, sludge digestion tank, sludge storage tank, and sludge beds. Each tank is 75 feet long, 16 feet wide and 7 feet average depth, giving a detention period of 3.25 hours for the present population of 10,000, and 2.3 hours for the future estimated population of 14,000, with a velocity of flow of about 0.1 inch per second. Future construction of two additional units is provided for. An office building contains the sludge well, pumps, drainage well and water supply well, and the laboratory. The water supply is derived from the underground water at the site.

1932 ENGINEERING

The cost of this modern sewage treatment plant was less than $4 per capita. It was designed to treat the wastes of 14,000 people. The officials of Saranac Lake have thus eliminated a problem that has been a sore spot for nearly 20 years.

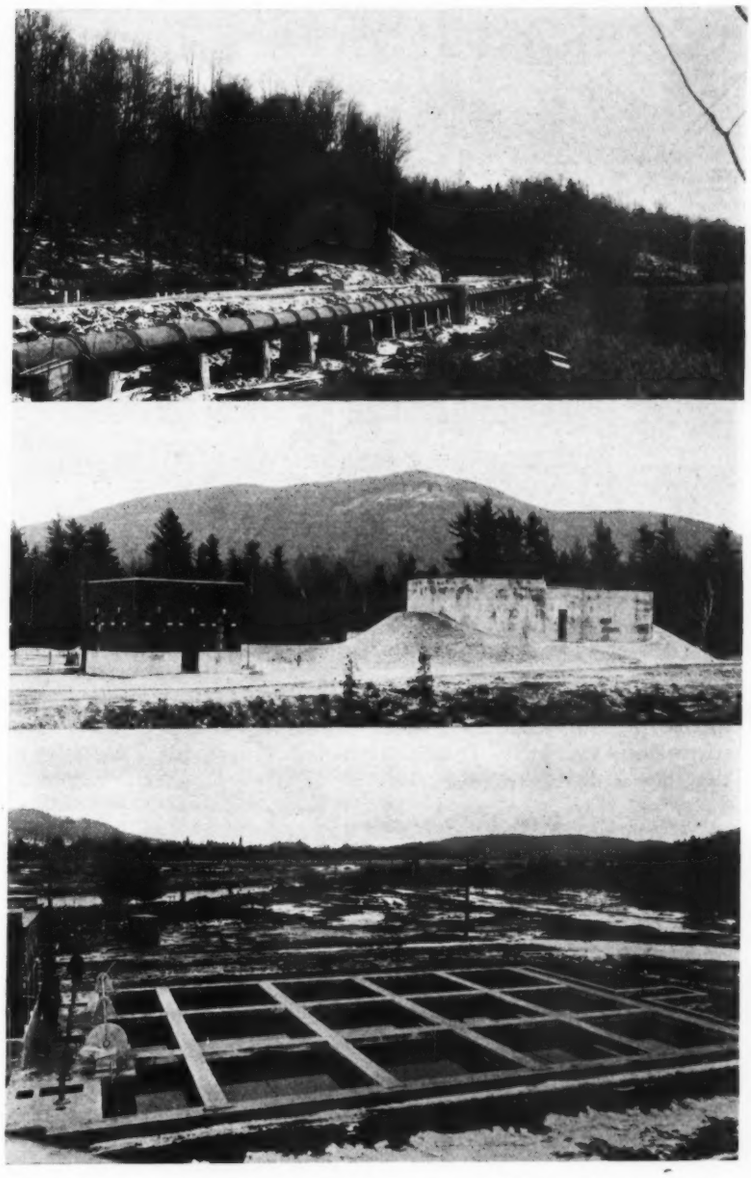
At the disposal site a fine sand in water was encountered at the proposed elevation of the bottom of the sludge pockets. When consolidated, this sand provided adequate bearing value. Consequently, the elevation of the sludge pockets was raised so as not to disturb this sand and a cylindrical pipe section, three feet long, was installed as a caisson, forming the bottom area of the sludge pocket. The sludge discharge pipe was set in this cylindrical section. The results of this design have been very satisfactory from an operating point of view.

As the bottom of the settling tanks is some four feet below the ground water level, it was necessary either to design the tanks against flotation, or to underdrain them and pump out the ground water each time it might be desired to a drain a settling tank. The latter design was adopted and tile underdrains were installed beneath the floor of the tank,

which was not designed to resist upward pressure. Tees extend through the floor of the tanks, with scuppers which will blow in case the operator should fail to de-water prior to draining a tank unit.

The sludge in the settling tanks is blown into sludge manholes, which drain to the sludge well. The sludge pumps deliver it to a cylindrical sludge digestion tank which is heated by a hot water heating system, consisting of 2″ tempered copper tubing with welded joints, a circulating pump and a B-Line heater with four gas burners burning sludge gas and recording meters for temperature, water, gas, etc. The B-Line heater was set about 9″ above the floor and, to start the plant, the gas burners were removed from the boiler and a vertical-type kerosene burner with a capacity of about 270,000 BTU per hour was installed underneath the boiler proper. The circulating pump has a capacity of 8 gallons per minute, and with a 40 degree drop in the temperature of the circulating water there results a value of about 4 million BTU per day, or two thirds the capacity of the gas burner. When sufficient gas is produced, two gas burners can be replaced in the boiler and the kerosene burner be reserved to heat the remaining boiler sections. (This method of placing a digestion tank in operation has worked out successfully at the plant at Rome, N. Y.)

There is also an unheated sludge storage tank, and between these two sludge tanks is a control house which contains the heating system, and piping and valve control so that fresh sludge can be delivered to either the digestion tank or the storage tank; or the sludge from either tank can be returned to the sludge well and repumped to the other tank, so that the tanks can be "turned over." Also digested sludge can be discharged either to the storage tank or to the sludge bed area.



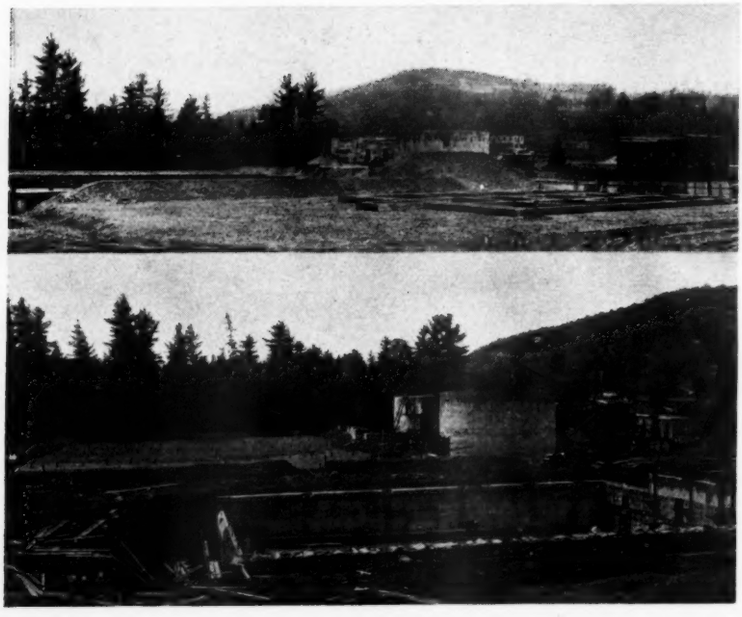
Top—Cast-iron sewer supported on piers. Center—Office building and sludge tanks. Bottom—Settling tanks. River in background.

The sludge bed area is provided on the basis of 1 foot per capita for the future population of 14,000 people. The beds are equipped with industrial tracks and light truck chasses which can be moved from one track to another by two men. These chasses will be equipped with a plank platform onto which the dried sludge will be shoveled, and carried to and dumped onto a storage platform at the east end of the sludge bed area. A depressed roadway extends along this platform so that the dried sludge on the platform can be pushed into a truck body.

Cast Iron and Vitrified Trunk and Outfall Sewers

The extension of the sewer involved two problems—the avoidance of infiltration (since the existing sewer was below normal water level of the river), and the laying of the trunk sewer in a rugged country near a steep river bank. In many sections the use of vitrified pipe seemed impracticable, and cast iron was used. The sewage is carried across the river through two 20-inch cast-iron siphons, and the outfall sewer is cast iron with three outlets spaced across a deep section of the river, as shown in the plant layout.

The trunk sewer extensions were constructed on the same gradient as the existing sewer for a distance of 1,600 feet, using universal cast-iron pipe. At the end of this section, a pumping station was installed which lifted the sewage vertically to such an elevation that subsequent flow would be on a gravity basis and the disposal plant would be above flood flow conditions. The sewer line consisted of 7,000 feet of 20-inch and 24-inch cast-iron pipe, and 30-inch tile. The 20-inch cast-iron pipe was used



Top—General view of plant. Bottom—In background, sludge beds and sludge tanks. In foreground, settling tanks under construction.

for the siphons under the river and for the pump discharge main, while the 24-inch was laid on a slope to produce a capacity equivalent to the 30-inch tile pipe laid at 0.06% slope.

Plant Experimentation

A series of very interesting experiments are being made on one of the settling tank units during normal working conditions, to obtain data regarding operation of parallel sludge collectors, and on deposition of sludge over different sections of the tank length. These data may make it possible to make rather radical changes in the standard design of this shallow type of settling tank.

Plant Operation

Samples of the effluent from these settling tanks settled in an Imhoff cone have shown only slight discoloration at the tip of the cone, when a spotlight is thrown beneath the cone.

The sludge collectors are operated for one-half revolution twice a day. The volume of fresh sludge removal averages about 25 cubic feet of wet sludge per thousand of population per day. The returning flights of the collectors maintain very satisfactory skimming of the top of the tank. A recording effluent weir gauge records the total flow of sewage through the tanks. A special weir was installed to read the discharge of one unit only, for experimental purposes. The pumping station is automatic and is visited twice a day for inspection, oiling and greasing and raking of the screen in the suction well.

A daily report sheet covering the operation of this type of plant is illustrated herewith, the data given being for a similar plant at Rome, N. Y., since sludge digestion at the Saranac Lake plant is not yet in full operation.

Cost of Project

The cost of the sewage plant proper, as derived by unit prices and segregation from a lump sum bid, was less than $50,000. The plant as it stands is designed for 14,000 people and the unit cost is less than $4.00 per capita. The total cost of the work including the trunk sewer extension, the cost of the land, engineering and legal expenses, amounted to $138,000. The trunk sewer was designed for a population in excess of 20,000 people. The total present costs for 14,000 people is less than $10 per capita. When additional units are installed at the sewage works site for 20,000 population, the unit cost for the total project will be reduced to about $7.50 per capita.

The contractor for the work was W. L. Lose of Tonawanda, N. Y., the pumps were supplied by Worthington Pump & Machinery Corp., and the electrical apparatus by the General Electric Company. The parallel sludge collectors were furnished and installed by the Jeffrey Mfg. Co. of Columbus, Ohio, and the heating boilers in the office building and for the sludge digestion tank are of H. B. Smith & Company manufacture. The Universal pipe and fittings were furnished by the manufacturers, the Central Foundry Company, New York City.

PLANT AT Rome, N.Y. | OFFICE OF HENRY W. TAYLOR | FILE 335 U

SUPERINTENDENT W. Kernan | OPERATION REPORT | DATE 2-19-32 | WEATHER Snow

PUMPING STATIONS — HIGH LEVEL — LOW LEVEL

Float Switches / Motors

Temperatures: Outdoors A.M. 27° P.M. 29° — A.M. 27° P.M. 29°
Motor Room A.M. 42° P.M. 46° — A.M. 41° P.M. 50°
Pump Room A.M. 43° P.M. 44° — A.M. 40° P.M. 44°

Power: Today Time 8:10 Meter 1544 — Time 7:55 Meter 8655
Yesterday Time 8:10 Meter 1531 — Time 7:55 Meter 8345
Difference Meter 13 — Meter 310
Period 24 KWH 520 — Period 24 KWH 310

SETTLING TANKS:
In Operation 1 ✓ 2 ✓ 3 ✓ 4 5 6
Sewage Flows—Max. 6.64 Sec. Ft. Av. 5.44 Sec. Ft. Min 4.31 Sec. Ft.
Sludge Collector ½ Rev @ 9 A.M. ½ Rev @ 1:30 P.M.
Sludge Withdrawal: Time 11 A.M. 433 cu. ft. Time 3 P.M. 383 cu. ft.
Power: Today Time 9 Meter 1437
Yesterday Time 10 Meter 1429
Difference Meter 8
Period 23 KWH 8

SLUDGE TANKS:
Temperatures: Outdoors 27° A.M. 29° P.M. Control House 44°
Sludge—Top 79° Middle 79° Bottom 76°

HEATING SYSTEM:
Supply Temperature 102° Water Meter 167323 9 A.M. Today
Return Temperature 89° Water Meter 165010 9:30 A.M. Yesterday
Temperature Drop 13° Cu. Ft. Water 2313 23.5 Period
BTU Per 24 Hours 1,880,000

FLOATING COVER:
Elevation 17'-9" Time 9:30 A.M. 29.11 Barometer
Elevation 18'-0" Time 9:30 P.M. 29.03 Barometer
Gas Production: Meter 138046 Time 9:30 Today
Meter 153224 Time 9:30 Yesterday
Cu. Ft. 4822 24 Period
Withdrawal: Supernatant Liquor 2,750 cu.ft. Sludge to
Lime used 1 Bags

Tests: pH 7.0 Top 7.0 Middle 7.2 Bottom
Imhoff Cones: 3.75 ml. Raw 0.3 ml. Effluent
Putrescibility: Sample Dated 2-13
Color Maintained ✓
Color Disappears
Days
Dried Sludge: Removed from Bed No.
Disposal

REMARKS:
Fresh sludge temp. 48°

Operating report of plant at Rome, N. Y., showing data obtained from plant operation.

Increasing Concrete Paver Efficiency Thirty-two Percent

By P. M. Tebbs

Ass't Chief Engineer, Pennsylvania Dept. of Highways

IN 1929 the Pennsylvania Department of Highways, through its inspectors, kept a detailed record of the available paving time, time lost, actual paving time, and rate of progress, in laying concrete on eight contracts totaling nearly 5,000,000 square yards. A summary of the results of this study is shown in the accompanying table. "Available time" was not considered to include any in which the contractor could not work on account of rain, with subgrade and other natural conditions over which he had no control. The "lost time," therefore, was that in which he did not work due to faults and deficiencies in his organization and management.

Mixing time in Pennsylvania is 1¼ minutes after all materials have entered the mixing drum. Allowing ¼ minute for loading and discharging, a modern paving mixer should turn out 40 batches an hour. But the production in 1929 averaged only 24 per hour, or 60 percent of the maximum capacity. No industry can be in a healthy condition which operates only 76.4 percent of its available time, and when in operation produces at only 60 percent of maximum capacity, a combined efficiency of only 46 percent.

Similar studies have been made in the past by the Bureau of Public Roads and reports have been prepared by them calling attention to these conditions. But they did not give specific directions as to *how the condition could be corrected.* At a meeting with the Pennsylvania Construction Association, held in Harrisburb during the spring of 1930, Department representatives were informed that the construction industry would welcome suggestions from the Department tending to increase their time and operating efficiency.

Study and research were continued during the winter months with special attention paid to the proper unit of comparison between the various jobs, the time of mixing cycle, and the method of actual operation of the mixer; including the moving which would result in the smallest possible amount of lapsed time.

In establishing the unit of comparison, the number of batches per hour proved the best method. For length in feet per hour would be affected by the size of paving mixer and the different widths and depths of pavement, and square yards per hour would be affected by the size of paving mixer and the different depths of pavements.

The mixing cycle of 1½ minutes per batch for maximum efficiency was based upon continuous operation of the mixer, including the time of moving on the subgrade when pouring of pit was completed. This meant that a section of subgrade would have to be ready at all times to receive a batch of concrete, and a truck or other batch-carrying equipment would have to be available at all times for charging the skip. The responsibility for having subgrade and truck available was purely a question of proper and coordinated management, but it became apparent during the study that efficiency of operation could be increased materially by changing slightly the requirements for testing subgrade before concrete was deposited, also that the mixer operator was a most important factor in efficiency.

To maintain the cycle of 1½ minutes, it is absolutely necessary to open discharge immediately when bell rings and locking device releases. A delay of a second in this operation will destroy the maximum efficiency schedule. Also, immediately upon release of discharge, skip must be raised so that batch will start into drum as the last portion of the former batch leaves the drum. While the mixing time is 1¼ minutes, it requires about 5 seconds to empty skip after it is in upright position. This 5 seconds must be considered in the mixing cycle and is a most important factor.

Efficiency Report on Concrete Paving Operations, Year 1929

	Length Paved 1929	No. Sq. Yds. Paved 1929	Working Hours: Possible Number	Working Hours: Hours Lost	Working Hours: Actual Number	Per Cent Time Lost	No. Sq. Yds. Pavement Laid Per Working Hour
Division No. 1	102.10 Mi.	1,068,836.41	12,121.37	2,177.42	9,943.95	18.0	107.5
Division No. 2	30.76 Mi.	314,328.00	3,665.00	544.915	3,120.085	14.86	100.74
Division No. 3	59.05 Mi.	657,263.00	7,653.25	1,437.00	6,216.25	18.8	106.00
Division No. 4	53.10 Mi.	572,565.00	7,320.00	1,777.00	5,543.00	24.0	103.00
Division No. 5	72.34 Mi.	824,070.00	14,144.00	3,645.50	10,498.50	25.78	78.49
Division No. 6	59.64 Mi.	641,979.00	9,862.00	3,454.00	6,408.00	35.0	100.18
Division No. 7	34.95 Mi.	389,068.00	3,839.00	455.00	3,384.00	12.0	115.00
Division No. 8	42.99 Mi.	491,852.20	6,604.25	1,904.25	4,700.00	28.8	104.70
GRAND TOTAL—STATE	454.93 Mi.	4,959,961.61	65,208.87	15,395.08	49,813.79	23.6	99.57

Reasons for Lost Time

	Transportation: Hours	Transportation: Per Cent.	Water Conditions: Hours	Water Conditions: Per Cent.	Sub-grade and Forms: Hours	Sub-grade and Forms: Per Cent.	Breakdowns: Hours	Breakdowns: Per Cent.	Lack of Materials: Hours	Lack of Materials: Per Cent.	All Other Causes: Hours	All Other Causes: Per Cent.
Division No. 1	336.27	2.8	110.35	0.9	458.42	3.8	483.19	4.0	481.55	4.0	307.64	2.5
Division No. 2	11.0	0.30	11.833	0.32	116.583	3.18	117.416	3.20	87.00	2.37	201.083	5.49
Division No. 3	89.00	1.2	21.75	0.3	139.50	1.8	276.50	3.6	237.75	3.1	672.50	8.8
Division No. 4	290.0	4.0	79.0	1.0	489.0	7.0	198.0	3.0	325.0	4.0	396.0	5.0
Division No. 5	271.00	1.92	172.25	1.22	1080.75	7.64	516.50	3.65	421.50	2.98	1183.50	8.37
Division No. 6	201.00	2.0	154.00	2.0	815.00	8.0	366.00	4.00	880.00	9.0	1038.00	10.0
Division No. 7	132.00	4.0	36.00	1.0	124.00	3.0	92.00	2.0	35.00	1.0	36.00	1.0
Division No. 8	370.00	5.6	80.75	1.2	429.25	6.5	252.25	3.8	140.25	2.1	631.75	9.6
GRAND TOTAL—STATE	1,700.27	2.61 11.05%	665.93	1.02 4.32%	3,652.50	5.60 23.72%	2301.86	3.53 14.95%	2,608.05	4.00 16.94%	4466.47	6.85 29.02%

Automatic paving mixers, which take the control out of the operator's hands to a very considerable extent, have been most vital in increasing progress and efficiency, but it still is most essential to have an operator who is intensely interested in the progress of the work and who places loyalty to his employer above his interest in the whims, fancies, and desires of the men working on the job.

The old method of the Department in checking subgrade before placing concrete provided that the entire length of pit had to be checked with subgrade tester, pit corrected and rechecked, the process being continued until entire area was satisfactory. This resulted in a continuous loss of time if a portion of the pit farthest from the mixer was correct and high spots had to be removed from the area nearest the mixer. To relieve this obvious loss, the Department adopted the policy of permitting concrete to be deposited on the grade after one-half the pit was checked and corrected, with the understanding that the subgrade tester was to remain on the forms at the point to which subgrade was correct and that no concrete was to be placed on the side of the subgrade tester where subgrade was not correct.

With the mixing cycle established, the important problem remained to eliminate the time loss when the mixer moved, and the following method was decided upon as the most efficient and economic:

1. Discharge bucket and load drum, keeping skip in air.
2. Dump concrete in pit.
3. Move to new position.
4. Lower skip to ground.
5. Fill skip from batch truck.
6. Discharge concrete into bucket and load drum.

This method of operating permits continuous mixing while paver is moving to new position. Dumping concrete in pit before moving permits the move to be made with an empty bucket so that if subgrade, which is an unknown factor, is not corrected to receive concrete in new pit, the next batch can be placed in bucket and the mixing cycle continued. This method combined with preparing one-half of the pit at a time was figured to eliminate all lost motion on a well organized job.

At the start of the 1930 season, quite a number of contractors were eager to adopt these suggested methods and on those jobs the progress increased immediately. In many cases the production was doubled over that of previous years. Comparative records were forwarded weekly to the central office. This information was tabulated and sent out weekly to contractors, material, equipment and surety companies interested in highway construction.

At the end of this season the records of all the individual jobs were again summarized. The percent lost time varied from 10.24 to 24.05, averaging 18.15; the number of batches varied from 24.31 to 33.66 per hour, averaging 29.56; and the square yards of pavement laid per working hour varied from 104.7 to 136.87, averaging 127.08. Following is a comparison of the essential factor for the years of 1929 and 1930:

		Working Hours						
Year	Length Paved	Possible	Lost	Actual	% Time Utilized	Batches Per Working Hour	% Maximum Efficiency	True Efficiency Average
1930	796.10	84,613	15,357	69,256	81.85	29.36	73.91	60.50
1929	454.93	65,209	15,395	49,814	76.40	24.00	60.00	45.84
Increase in efficiency in 1930 over 1929....					7.13		23.18	31.98

This tabulation is based upon the total number of jobs handled by each contractor. In some cases the record of the individual jobs shows a higher rating than the final average would indicate. In 1920, two or three miles per year was considered a season's work of placing concrete pavement. In 1930, several contractors paved more than fifteen miles with one paving outfit, and one contractor built seven jobs with two outfits.

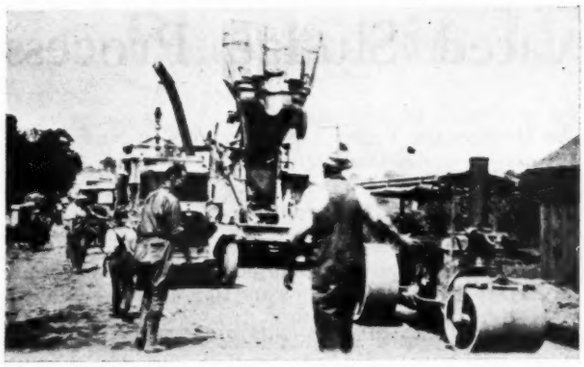
The efforts of the Department to increase operating efficiency and eliminate lost time and motion have been welcomed and appreciated by the responsible contractors of Pennsylvania. That the contentions of the Department were fundamentally sound and suggestions for correcting the conditions meritorious is proved by comparison of the 1929 and 1930 reports. The increase from 76.4% to 81.85% of the total available time or a 7.13% increase is fair, but leaves a large field for further study. The increase in the number of batches per hour from 24 to 29.56, an increase of 23.18%, is very gratifying. This will be enhanced still further during the present and succeeding seasons, as the contractors, with very few exceptions, are "sold" on the idea and will start the new season where they left off during the past season.

A comparison of the reasons for lost time for the two years is most illuminating. With 2.95% of the total time lost in transportation in 1930 as compared with 2.61% in 1929, and 3.61% of total time lost on breakdowns in 1930, as compared with 3.52% in 1929, we deduce the fact that increasing the time and operating efficiency tends towards more breakdowns of mixing and hauling equipment. To overcome this, further studies should be undertaken by the individual contractor, contractor's associations and equipment manufacturers to ascertain the principal breakdowns, so that corrections may be made in future designs and repair parts of frequent breakdowns stocked for existing machinery.

The decrease from the loss of 4.00% of total working time for lack of materials in 1929 to 1.72% in 1930 shows what can be done where an organized effort is made to correct a very specific condition. The fear of shortage of materials in 1930 caused every contractor, material producer, transportation executive, surety agent, and highway engineer to exert every possible effort to guard against an anticipated shortage. The cooperative committee which was organized from all representative branches of the industry also rendered invaluable service.

The decrease from 5.60% of the total time in 1929 to 3.94% in 1930 for losses due to subgrade and forms, while an improvement, is not very satisfactory. With the almost perfect weather conditions of 1930, the loss of time from this source should have been reduced to the absolute minimum instead of showing only a slight improvement. This again proves most conclusively that few contractors are capable of organizing to work every day, and, when weather permits continuous operation, they are not able to keep ahead of paving with a satisfactory amount of subgrade and forms. This was noted in numerous specific cases on inspection trips of Department representatives.

The greater loss of time in 1930 on account of water conditions was to be expected on account of drought. The figure of 1.27% of total time lost on this feature



Typical construction scene in Pennsylvania highway work

in 1930 as compared to 1.02% in 1929 is not very great and would have been much more had not the contractors exerted a great effort to combat a very obvious condition. The decrease in loss of time for miscellaneous causes shows a substantial improvement in 1930 over 1929 and this can be bettered to a very considerable extent.

The concrete road construction program in Pennsylvania for 1931 was curtailed considerably for the reason that construction had been completed on our main highways and a very large mileage of cheaper type road was constructed on our roads of less importance.

The completed figures of 1931 are not as yet available, but a summary of those already compiled show a time efficiency of 82.6% with an operation efficiency of 78%, or a true efficiency average of 64.4%, which proves conclusively that steady progress and improvement are being maintained and that the efforts of the Department are continuing to bear fruit to the advantage of every party comprising the industry.

The above is part of a paper (slightly condensed) read before the Ass'n of Highway Officials of the Northeastern States by P. M. Tibbs, assistant chief engineer of the Pennsylvania Department of Highways, based upon studies made by C. H. Buckius, construction engineer of the department.

Concrete Paving in Great Britain

Variations in Construction Practice, and Crack Data

The Ministry of Transport, of England, recently sent a questionnaire to highway authorities of Great Britain asking information concerning such concrete pavements as they had laid, and received 132 replies. These have been studied and a report issued by the ministry in which the information obtained is summarized as follows:

"The comparatively small number of replies received, the relatively large number of variable conditions involved, and the somewhat indefinite answers given to many of the questions made it difficult to draw definite conclusions.

"Some of the most interesting variations of practice indicated by the 132 replies received were:

"(a) One hundred and two roads were laid as two-course and thirty as single-course concrete.

"(b) Ninety per cent of the roads were from 6 in. to 8 in. thick, though one road was 10½ in. thick and the thinnest road (laid on an existing macadam road carrying light traffic) was only 5 in. thick.

"(c) In roads built on the continuous system the intervals between transverse joints were generally from 40 ft. to 60 ft., though in one case the interval was as small as 12 ft., and in two others as high as 100 ft. In roads constructed on the slab principle, the slab length was generally 15 ft. or 16 ft., though lengths of 30 ft., 40 ft., 60 ft., and even 80 ft. occur.

"(d) Sixteen roads were unreinforced concrete, three were reinforced at the top only, eighty-two at the bottom only, thirty-one were reinforced both top and bottom.

"(e) The period of curing varied from two days to more than four weeks, damp earth or sand being by far the most usual method employed. Silicate of soda was employed for curing six roads.

"(f) The cost of 82 per cent of the roads lay between 1s. and 1s. 9d. per sq. yd. per inch of thickness.

"It was found impossible to determine from the replies the influence of any one detail of construction or to separate the effect of one detail from another in such a way as to justify any particular conclusion. The information supplied, however, tends to suggest:

"(a) Transverse cracking was reduced by the use of transverse joints, but where reinforcement was continued across transverse joints the value of the joint in reducing transverse cracks was considerably less. This statement does not apply to doweled butt joints, as good results have been obtained in the case of three of the four roads in which these joints were used and the defects in the case of the fourth road were probably due to causes other than the type of joint employed.

"(b) The arrangement of the transverse joints, whether at right angles or inclined to the kerbs, and whether in line or staggered, did not have any marked effect on the development of corner cracks; some reports indicated a tendency for cracks to occur across acute corners, and, in a few cases of staggered joints, for cracks to develop in approximate continuation of the transverse joint.

"(c) The use of a longitudinal joint reduced the formation of longitudinal cracks.

"(d) Roads in which no attempt was made to prevent evaporation of water during curing were more liable to crack than roads in which such precautions had been taken.

"(e) Two-course roads did not withstand cracking so well as single-course roads.

"(f) Roads laid on a wet sub-course cracked less than those laid on a dry sub-course.

"(g) The six roads which were cured with silicate of soda were reported to be in very good condition."

These results are all in line with experience in this country. Two-course concrete pavements are very rare here, as are also diagonal joints. The agreement with American experience would seem to indicate that the ministry could study our experience to advantage in their efforts to guide the further construction of concrete roads in that country.

Present Status of Activated Sludge Process

AN excellent summing up of the present status of the activated sludge method of sewage treatment, and of the information concerning it which has been obtained by experience with operating plants, was given in a paper by Wellington Donaldson (of the engineering firm of Fuller & McClintock) presented January 21st before the Sanitary Engineering Division of the American Society of Civil Engineers.

After a general discussion of the process, he explains the interrelationship of local plant characteristics, including strength of sewage, degree of preliminary treatment, aeration period, amount of solids in the mixed liquors, deoxygenation, short-circuiting in tank, amount of air used, and final tanks. He then discusses the amount of power required. The causes, alleviation and prevention of sludge bulking is given consideration. Finally he gives data concerning the methods employed for disposing of the sludge—lagooning, drying on beds, boating to sea, use of vacuum filters and dryers, digestion, and incineration.

Introduction

"The activated sludge process is capable of dependably removing from sewage over 90 per cent of the suspended matter, over 90 per cent of the organic matter as represented by the biological oxygen demand, over 90 per cent of the ordinary saprophytic bacteria, and from 95 to 98 per cent of the bacteria which are associated with disease. When this type of treatment is supplemented by chlorination, the removal of objectionable bacteria can be made practically complete and the organic matter further reduced. Individual plants show greater reductions than indicated above as average good performance.

"The effluents of the more important activated sludge plants in this country contain on an average from 15 to 20 parts per million of suspended matter, and have a 5-day oxygen demand of 10 to 15 parts per million. An effluent of this composition, if well nitrified and well aerated, is not likely to putrefy for several days, even if not mixed with diluting water.

"The results obtainable by the use of the activated sludge process are in all respects as good as or better than those obtainable by the use of trickling filters, and the effluent is physically more attractive. The activated sludge process has moreover the advantages of very much smaller area required, freedom from the fly nuisance (which is serious in areas closely adjacent to trickling filters), and avoidance of odors which are at times objectionable when sewage is sprayed into the air."

That the advantages of the activated sludge process for large projects is being widely recognized is shown by the beginning of construction of New York City's Wards Island plant to serve a population of over 1,200,000; by the recent adoption of this process for the Easterly Sewage District of Cleveland, Ohio, to serve 770,000 persons; for the Stahnsdorf plant in the suburbs of Berlin for a population of 600,000; for the Mogden works of Middlesex County, England, to serve 700,000 persons; and by its recommendation for the Hackensack Valley District plants in New Jersey to serve a population estimated to be about 700,000 in 1947.

Summary

"Performances by plants of this process vary, and to facilitate discussion, attention is called to a number of factors bearing on design and operation, as follows:

"1. For large projects, this process is assuming a more dominant position where it is important to provide so-called complete treatment. It is readily feasible to supplement this process by chlorination or filtration or both, if necessary.

"2. For small plants, this process has a less favorable status than a few years ago, due to fluctuations in plant loadings and difficulties in securing adequate technical control.

"3. There are so many interrelated factors, involving the strength and flow of sewage, arrangement of plant and method of operation, that it is risky to use data from one plant for adoption elsewhere without due appreciation of various elements.

"4. Plant loadings, particularly, as affecting detention period in aeration tanks and quantity of air per gallon, are obviously influenced by the strength of sewage, which may average 75 to 225 gallons per capita daily; the degree of preliminary treatment; the relation between mean and maximum peak flows and strengths of sewage; and the extent to which industrial or other non-domestic wastes reach a plant.

"5. Suspended solids in aerating tanks range from 0.10 to 0.70 per cent by weight, perhaps 0.20 to 0.25 being representative of American practice, with the lower figures prevailing in Europe.

"6. There are wide variations in detention period in aeration tanks, air used per gallon and horsepower per million gallons. It would clarify data to express these elements on a per capita basis or in terms of a stated number of units of oxygen demand reaching the aeration tanks.

"7. Short-circuiting is a factor of considerable importance in some aeration tanks of the spiral flow type, and is of special importance with mechanical types depending upon continuous circulation of the entire tank content.

"8. Deoxygenation needs to be guarded against.

"9. Reaeration has its place for some situations and is coming somewhat in vogue again.

"10. Sludge bulking is not much of a factor at large plants dealing with dilute, well settled sewage, but is a factor at other plants. Its causes and remedies need elucidation.

"11. Sludge disposal by the use of heated digestion tanks and drying beds is thoroughly practicable, especially if the excess sludge from the final tanks is returned to the inlet of the preliminary tanks. Vacuum filters to produce a filter cake of 20 to 30 per cent solid content are also practicable. The drying of filter cake to make a fertilizer is not now a commercial success and for several projects attention is being given to incineration of the filter cake."

Blasting in Highway Grading

A Summary of Studies by the Bureau of Public Roads

THAT poor blasting is the rule rather than the exception in much highway grading work is the opinion of Andrew P. Anderson, highway engineer, Division of Management, U. S. Bureau of Public Roads, based on a study of 71 power shovel grading jobs on which considerable blasting was required. He found the blasting decidedly deficient on 43 of these, the material was fairly well broken on 13, and on only 15 was it so well broken as to permit rapid and fairly continuous shovel operation.

The field records of these 71 jobs were studied to learn 1—How and to what extent blasting affects the rate of shovel production. 2—What are the chief obstacles to such blasting as will permit a high rate of shovel production. 3—How and to what extent can these difficulties be overcome.

When the largest dimension of the larger of the fragments produced by blasting does not exceed about one-half of the smallest inside dimension of the dipper, the rate of shovel operation can be practically the same as in excavating good common earth; but poor blasting may reduce the rate by more than 50 percent. For all jobs studied during the past three years, the average operating cycle (filling dipper, discharging and returning to filling position) of 1 to 1¼-yard shovels working in materials classed as well to fairly well blasted rock was 23.5 seconds, while for the same size and type of shovel operating in poorly blasted material the average cycle was 33.5 seconds. On some very poorly blasted jobs (not included in the above average) the cycle was 45 seconds—an increase of more than 85 percent.

In addition, the amount of pay material moved per dipper load is seriously affected. For 1 to 1¼-yard shovels the dipper load average 0.7 cu. yd. of pay material in well blasted rock but only 0.5 cu. yd. in poorly blasted, and 0.4 cu. yd. where the blasting was exceptionally poor. Combining operating cycle and dipper load, the average reduction in production, excluding exceptionally bad jobs, was 50 percent, and 78 percent with exceptionally bad blasting.

There is also a loss of time due to handling large rocks. This varied from an average of 8.7 percent with good blasting to 16.3 with poor.

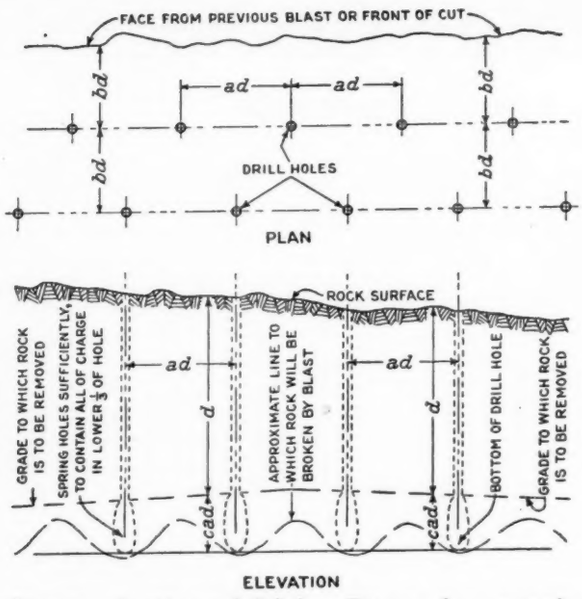
But the cost of the shovel operation is practically a fixed amount a day, and that of the hauling equipment nearly so. Two jobs were compared for a full week—each using a 1-yard shovel and having an operating cost of $21 per hour for loading, hauling and dump operation. During this week one, working in well-blasted rock, averaged 67 cu. yd. per hour; the other, working in poorly blasted rock, averaged only 36 cu. yd. The costs per cubic yard were therefore 31 1-3 cts. and 58 1-3 cts. respectively. It seems probable that better blasting would have cost less than 27 cts. a cu. yd. of material.

How to Secure Good Blasting

The studies made indicate that on a large majority of road grading jobs involving solid rock, hard shale or similar materials, more thorough blasting will pay. But blasting in such work differs greatly from quarrying or mining. The cuts are generally shallower, sometimes only a foot or two; the depth varies continually, as may also the material, dip of strata etc. These conditions add to the difficulties of securing good blasting. Moreover, the limitations placed on either over or under breakage on the side slopes, and frequently even in regard to the grade line, are numerous. Also it is often necessary to prevent injury to persons, passing traffic or neighboring buildings, which requires light shooting.

Drilling is usually the most expensive item in grading rock work, and improper location, spacing or depth of the drill holes is the most frequent cause of poorly broken material. The following method for deciding upon the spacing of drill holes is described in Mr. Anderson's report, published by the Bureau

Above: A good shovel, with a good operator can handle rocks like this, but it's expensive. Center: It takes more than good intentions to break up rock. Each of these large pieces must be shot again in order to be handled. Above, right: Here is rock so well broken up that it can be handled almost as well and rapidly as common excavation.



Suggestion for placing drill holes. Diagram shows part plan and part elevation of nearly level through cut

of Public Roads in the February issue of "Public Roads."

In the diagram, Fig. 3:

a=Ratio of depth of cut to spacing of holes across cut.
b=Ratio of depth of cut to spacing of holes from face, or of rows across cut.
c=Coefficient of depth of drill hole below grade. Its value, for most materials, lies between one-fourth and one-half, except in very shallow holes.
d=Depth of cut at drill hole.
ad=Distance between holes across cut.
bd=Spacing of rows or distance of holes from face to cut.
cad=Depth of drill hole below grade to which rock is to be removed.
d+*cad*=Total depth of drill hole.

On a number of jobs in reasonably homogeneous material the spacing between the holes in a row across the cut averaged about three-fourths of the total depth, usually varying from ½ to slightly more than the depth of the holes, while *b* was usually less than *a*. In ordinary shale, disintegrated granite and hardpan the spacing in deep cuts sometimes equaled twice the depth of cut, but was usually 1 to 1½ times. It is advisable when starting a new cut, to try two or three shots, with different depths and spacing for each group of holes, and enough holes in each group to give a good indication, to determine the most desirable values for *a*, *b* and *c*.

For most rock the spacing between holes need never be less than 4 ft. if the depth of hole is 4 ft. or more and penetrates at least 18 in. below grade of removal. In very tough or blocky material a spacing of over 10 or 12 ft. will usually require drilling secondary holes to about 1-3 to ½ the depth of cut in the middle of the areas formed by a primary hole at each corner.

In very shallow cuts it is usually advisable to drill considerably below grade, to permit a wider spacing and reduce drilling cost. Since the drilling costs much more than the explosives, it is generally economical to reduce to a minimum the feet of drilling per cubic yard of rock to be broken, at the cost of heavier charges: but this may not secure the desired breaking into small pieces or safety to persons and property, and these must not be sacrificed to economy.

Costs of Drilling

On typical projects the average cost of drilling in fairly hard, uniform rock with the customary jackhammers was nearly 30 cts. per linear foot of finished hole. But because of the varying nature of rocks the cost varies over a wide range and may cost double this. The depth of hole, type of equipment and management also affect the cost. On the jobs studied the feet drilled per hour while the drill was in operation averaged 21.2 in limestone, stratified, with clay seams; 24.2 in hard limestone, stratified but of uniform hardness; 28.9 in granite, porphery, felsite, trap and basalt; and 36.2 in sandstone, hard shale, hardpan, and disintegrated granite. But the feet drilled per hour of total day varied from 11.5 to 15.5, and the total lost time varied from 36.1% to 62.0%. Cleaning or blowing holes accounted for 27 to 11% of this lost time, changing drills for 20 to 17%, and the remainder was lost because of steel stuck or broken, moving to new holes, springing holes, mechanical trouble, waiting for steel and other causes.

In general, too little attention is given to the size and condition of the air pipe and hose. One job showed a loss of one pound of pressure per 16 feet of ¾-inch hose and iron pipe. Two-inch or 2½-inch pipe for 4 to 6 drills on other jobs showed less loss.

Amount of Explosives

The amount of explosives required per cubic yard of identical pay material is generally larger in highway grading than in most classes of rock work, since it is so essential that all the material be broken into fragments small enough to permit fast and steady operation of the shovels. This is generally because of closer spacing of the holes and lifts of moderate depths rather than larger charges. In very hard, tough materials the holes should always be sprung so as to form at the bottom a cavity which will hold most of the charge. The amount of dynamite used in springing where good breakage was obtained varied from 1 pound per 50 cu. yd. of pay material in basalt and disintegrated granite to 1 pound per 4 cu. yd. in very hard felsite. The amount used in blasting in the former case was 1 pound per 2 cu. yd. and in the latter 1 pound for 1 cu. yd.

In beginning operations in an untried rock, it is best to fire two or three test blasts, using different spacing and charges of explosives to determine those giving the best results. A blasting charge of 1 to 1¼ pounds of 50% to 60% dynamite per cubic yard of burden is suggested for a trial in hard and tough materials, using values for *a*, *b* and *c* in the spacing formula of ½ in each case. For less hard rock, use 2-3 for *a* and *b* and 1-3 for *c*. For rocks which shatter readily, use values of ¾, 2-3 and 1-3, respectively, and 1¼ lbs. of 40% dynamite. For ordinary shale and similar materials use values of 1¼, 1 and ¼, respectively, and ⅞ to 1 lb. of 20% dynamite or black powder.

A foot of drill hole seldom costs less than a pound of high-grade explosive, and often as much as two pounds; and the spacing should therefore be the greatest that will give the desired fragmentation. But if a given spacing results in much rock being broken in too large pieces, the spacing should be reduced.

How Noblesville Reduced Its Mosquitoes Eighty Per Cent

FOR years Noblesville, Ind., has suffered almost unbearably from mosquitoes during the summer months. One or two rather unorganized efforts to control them were attempted but without much success. The year 1930 was an unusually dry one, but the mosquitoes were more numerous than ever. R. F. Harris, health officer of Noblesville, said that he personally spent more than ten dollars on spraying liquids, and that the health board received more complaints than ever before. The park and golf course were practically abandoned after August 15. The situation became not only annoying but a serious detriment to the city, and at a meeting of the Kiwanis Club, the city board of health and citizens a concerted move to remedy matters was decided upon.

As a start, the board named April 13 to April 20, 1931, as a "Clean-Up Week," during which each resident should place all rubbish, but especially tin cans and other possible retainers of rain water, where they could be collected by city employees. Almost every citizen responded, so that it required three weeks to complete the collection, after which most yards and alleys were in excellent condition. Meanwhile a crew of men had been cleaning out eave troughs, and an order was issued to cover tightly all rain barrels, abandoned dug wells and other artificial containers of water. Oiling of mosquito-breeding areas was begun about April 8 and was carried on daily by three men.

With the help of Dr. Wm. F. King, State Health Commissioner, the city secured the services of Sanitary Engineer L. M. Fisher of the U. S. Public Health Service, who made a complete mosquito survey of Noblesville and outlined a method of attack. His survey included the entire town and all of the surrounding country within about a mile. It was found that nearly all of the mosquitoes came from sedimentation pools maintained by a local manufacturing plant, but also mosquitoes were found to be breeding in several ponds along the river, ditches, a pit in the old carbon plant, a concrete pit in the steel plant and in fire barrels at the canning factory. With the exception of the sedimentation pools, the other breeding areas were controlled by weekly inspection and oiling where larvae were found. These areas could be controlled permanently by filling in the pits, and digging ditches to drain the other places. but was not done, owing to lack of funds.

Controlling measures at the ponds owned by the manufacturing company, however, were not simple. Since the plant is only ten or twelve miles from the point where the municipal water supply for Indianapolis is taken from the river, it has been enjoined from discharging its wastes into the stream. The company, therefore, has been compelled to store the water until it evaporates or seeps away in the ground, in a series of large ponds created by throwing up a high dyke or levee along the river. There are four of these ponds; the smallest is nearly filled up, but the largest is 1,000 to 1,500 feet long and about the same in width. It acts as a sedimentation basin and a huge septic tank, in which digestion goes on quite rapidly, and much gas is found and a scum rises to the surface. In places this scum becomes thick enough to support vegetation and drifts about in the form of "floating islands" of grass and rushes. This pond is our largest source of mosquitoes.

The only means we have of controlling breeding on these ponds is by spraying oil. This we were able to do quite satisfactorily on the smaller ponds, but not so successfully on the largest pond just described, because the dense vegetation made much of the area inaccessible. Most of the oil was applied by means of knapsack hand sprayers put out by the Dunn Machinery Company of Atlanta, Georgia. Some was spread by means of a small rotary pump, about three inches in diameter, bolted onto the cooling tank of a 1½ H. P. Fairbanks-Morse portable gasoline engine. The pump and engine were placed aboard a flat-bottom boat and used on the ponds. With this pump a jet of oil could be thrown about 30 or 40 feet and a barrel of oil could be spread in about three quarters of an hour.

Some of the oil used was crankcase oil obtained from garages and filling stations; some was fuel oil; and some was crude oil obtained from a nearby oil well. Kerosene was used to thin the oil down. With the exception of that obtained from the local garages and filling stations free of charge, the manufacturing company generously furnished practically all of the oil.

One of the men employed to carry on the work was made supervisor. It was his duty to make weekly inspection tours of the breeding places, and by means of dipping, determine where the breeding was going on. In this way unnecessary oiling was avoided. Only such areas as contained full-grown larvae or pupae were oiled.

In addition to oiling the places above mentioned, all of the catch basins and sewage outlets in the town were oiled routinely every ten days.

The cost of these operations, which were carried on daily for nearly six months, was considerable. The city paid $1,279.04 in salaries and equipment, and the manufacturing company paid $380.17 for oil and $508.25 for the labor of one man who worked with the crew employed by the Board of Health. All told $2,167.29 was spent.

The above is abstracted from a paper by Dr. Harris presented at the conference of Indiana State Health Officers. In concluding he said:

"I feel certain that practically every individual in Noblesville will bear me out in saying that conditions this summer have been 80 per cent better than in former years. We have had some mosquitoes, but nothing in comparison to years gone by. The golf course and park are just as popular now as they were early in the summer. I might add that I have found it unnecessary to pay out one penny for mosquito poison of any kind."

Handling Concrete by Portable Conveyors

By G. L. Tarlton
Contractor, St. Louis, Mo.

At St. Louis, Mo., a terminal warehouse and depot, known as the Illinois terminal project, is being constructed at an estimated cost of $15,000,000. The project includes a subway under High street, the roof of the subway serving as the street surface. This roof, 100 feet wide and 2,200 feet long, is constructed of reinforced concrete 10 inches thick, running about 5½ cu. yds. of concrete per lineal foot and containing 700 lbs. of reinforcing steel per foot.

Portable belt conveyors were used for conveying and pouring the concrete, these being selected in preference to building a ramp or other of the usual methods of handling concrete, because this involved the least preparation expense and enabled the pouring of the roof to progress uniformly and flexibly. These were used in series, that is, the truck dumped into one, which fed into a second and that into a third, etc.

The concrete was 1-2-4 mixture, 4 in. to 5 in. slump, delivered from a central mixing plant in "bath-tub" body trucks, containing 2.1 yards each. The pouring schedule called for a load every three minutes. To accommodate somewhat the distributing and tamping, about 1½ to 2 minutes was taken to discharge concrete from the truck onto the first conveyor.

The plan of pouring was to advance in 20-ft. sections the full 100-ft. width of the roof. A total of eight Link-Belt portable belt conveyors were used at times, which gave a conveying line of slightly more than 200 feet. These conveyors were 26-ft. centers, 24-in. wide belt, and were of standardized type, except that a V-shaped rubber scraper was applied to the return run to keep the belt clean. The belt speed was 150 feet per minute and the rate of handling 1 to 1¼ yards of concrete per minute. Labor involved to distribute the concrete consisted of 11 laborers, 2 hoisting engineers, and 1 oiler.

To accommodate the 100-foot width of pour, the conveyor line was moved generally 5 times for each 20-foot section of floor length. This shifting required a slight delay, depending on the number of conveyors in use at the time; usually less than a minute was taken to move and line up a conveyor. To aid when resetting and lining up, each conveyor was provided with a wide hopper on the foot end, to place the concrete properly on the belt. A complete 20-foot section, 100 feet wide, was poured in about 4½ hours. Each of the conveyors was powered by its own 8 H.P. Le Roi engine, and complete flexibility was therefore maintained at all times.

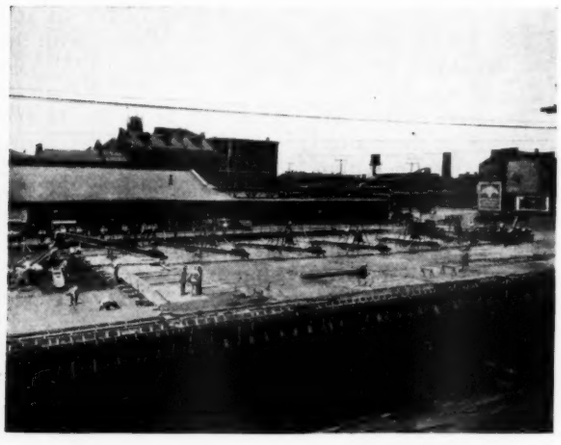
The companies and men on this job are: Contractor, G. L. Tarlton, Ambassador Bldg., St. Louis; general manager, J. C. Hail; general superntendent, Frank Munro; supervising engineers, H. Merker, Merker & Co., St. Louis. The Link-Belt portable conveyors were furnished through Geo. F. Smith Company.

Power from Sludge Gas in England

The Birmingham, Tame and Rea District Drainage Board have authorized an application to the Ministry of Health for sanction to borrow £5,770 for a waste-heat recovery plant at the Saltley works.

The Works Committee reported that the results obtained from the operation of the sludge gas power plant at the Saltley works more than justified the estimates upon which the scheme was based, and with the board's growing demands for electricity they advised that further efforts should be made for increasing the output from the three existing gas engines. They were informed that, with this object, additional sludge gas could be made available by the installation of a plant which would cause the sludge in the primary digestion tanks to be maintained at a considerably higher temperature than at present, and that this could be effected by utilizing the recoverable waste heat from the gas engines and transmitting it to the sludge in the digestion tanks. The total cost of the scheme amounted to £5,770, and it was estimated that the income to be derived from the additional power produced would show a surplus after making provision for loans and maintenance charges.

Further advantages anticipated from the adoption of the proposals were that the installation of another gas engine to meet future requirements would not necessitate the provision of new gas collectors, and that the need for additional digestion tanks either at Saltley or Minworth works would be obviated for many years.—*"The Surveyor and Municipal and County Engineer."*



Constructing subway roof to serve as street surface

Handling concrete by portable belt conveyors used in series

Recent Sewage Investigations in Maryland

THE Bureau of Sanitary Engineering of the Maryland State Department of Health, of which Abel Wolmen is chief engineer, embraces in its activities the oversight of a great variety of sewerage and water supply plants and the solving of many problems arising in connection therewith. The bureau's report for 1931 contains brief descriptions of several problems studied during the year, of which several of the most interesting are quoted below:

"For some years, the concrete in the primary settling tank at the sewage treatment plant at the Maryland Tuberculosis Sanatorium has been disintegrating. The thin partition walls of the settling compartment were particularly affected. We finally recommended that this structure be converted into a separate sludge digestion unit and that a plain settling tank be constructed in its place. In the work of reconstruction, it was found necessary to repair some of the disintegrated concrete. It was finally decided to have this done with "gunite." All of the construction was done by the institution's labor, with the exception of the guniting. The cost of these improvements amounted to $2,400."

"The trickling filter of this sewage treatment plant, which has been in operation for approximately fifteen years, has been giving very poor results for some time. An investigation indicated that the filter stone was packed with humus, probably due to the fact that the filter did not slough off sufficiently to remove this material. Inasmuch as removing the stone, cleaning it and replacing it would involve considerable time and money, it was decided to try the application of chlorine to the bed. Considerable work along this line had been done at Schenectady, N. Y., with satisfactory results. Arrangements were made to treat similarly the trickling filter at this institution. A drum of HTH, a hypochlorite of 65 percent available chlorine, was used. The HTH was mixed in solution in a barrel over the dosing chamber and the dose set so as to give a treatment of 25 p.p.m. of chlorine. Due to freezing weather at night, this treatment was applied during the daytime for nine consecutive days.

"After the treatment was completed, considerable improvement was noted in the appearance of the bed. The brown, leathery coating which covered the stone on the surface of the trickling filter was entirely gone and most of the material which formerly was packed in between the stones, had sloughed off. As the test was just completed at the end of the year, no laboratory data are yet available as to the improved operation of this unit. The removal of an over-accumulation of solids, however, should permit greater oxidation in this unit."

"The first practical installation of the 'lime-chlorine process' for the treatment of sewage was at the Baltimore sewage treatment works. This recent development incorporates the application of lime along with chlorine. The hypothesis in this process is that the efficacy of chlorine is increased due to the fact that chloramines are more readily produced from alkalinized chlorine. Less chlorine is required to satisfy the demand of the sewage and the residual chlorine is more permanent. In practice at the Baltimore plant, lime is fed from dry feed machines at a continuous rate. This is carried in aqueous suspension to the point of application through a pipe line into which chlorine is discharged from a battery of chlorinators at measured rates. The reaction between the lime and chlorine is practically instantaneous, forming alkaline calcium hypochlorite solution which is applied to the plant effluent. An excess of lime is maintained and controlled by reaction tests with phenolphthalein. The requisite ratio of lime to chlorine has been found to be about 1.25 to 1.00. The Baltimore plant treats an average of 60 million gallons of sewage per day and the treatment consists of screening, settling, trickling filter and final settling. The lime and chlorine requirements have averaged about 3,750 and 3,000 pounds of lime and chlorine per day, respectively. During the plant scale tests, in adjusting dosages to produce an average residual chlorine of 0.5 p.p.m., it was observed that a residual of about 1.0 p.p.m. usually prevailed during the late morning hours and 0.2 p.p.m. near midnight. These results agree with the general distribution of the sewage loads at Baltimore where the average time of travel of the sewage from the City to the plant is about twelve hours. . . . Algae growths in Back river have been considerably reduced. Whether or not the lime-chlorine treatment has been a significant factor is as yet undetermined."

"During the latter part of the year the Bureau of Sewers of Baltimore has been conducting experiments upon ripe digested sludge with a pilot scale oscillating, continuous-type vacuum filter manufactured by Bartlett Hayward Company, Baltimore, Md. The filter, known as the "Genter" type, consists essentially of individual tubular elements arranged in squirrel-cage fashion about a central shaft. The squirrel-cage construction is open at one end. The cantilever elements forming bars of the squirrel-cage act not only as filter elements, but also as oscillating, agitating arms as they work their way progressively through the sludge bath contained in a tank into which the elements are submerged. A gear-driven mechanism oscillates the central shaft and elements in a progressive manner around a complete circle. Speeds of oscillation and advance are adjustable to the character of the material. The tubular elements are clamped at one end to a spider containing the filtrate conduits which lead to a rotary valve at one end of the central shaft. This valve controls automatically the application and cessation of suction on the tubes entering submergence and leaving the drying arc and then permits the application of atmospheric or low pressure air to discharge the cake.

"The experimental unit used in the tests had a filter area of about 18 square feet and consisted of 80 mesh phosphor bronze. Ferric chloride was being used as a coagulant at a pH of 4.8. The moisture of the dried sludge was in the neighborhood of 75 percent. The pH of the digested sludge before treatment was about 6.9. The filter effluent was about 6.3.

"These tests are in the preliminary stage and there are no commercial installations of the equipment in use upon sludge. Similar tests with a recent type of Dorr filter were being arranged for at the close of the year. Detailed reports upon the experimental work will be published by the Baltimore city authorities upon the completion of the studies."

RECENT LEGAL DECISIONS

Concerning Municipal Public Works and Municipal Officials

By John Simpson

Requirements of Public Improvement Ordinance

A valid ordinance is the basis of every special assessment under the Illinois Local Improvement Act, and if the ordinance is void the court has no power to confirm the assessment. One object of the requirement of the statute that the ordinance shall specify the nature, character, locality and description of the improvement is, that those charged with the duty of making an estimate of the cost of such improvement may make an intelligent, just and fair estimate thereof; and another object is, that since such ordinance is the basis for all contracts for the construction of the improvement, it should contain, either upon its face or by reference to specifications on file in the office designated by statute, the data necessary for estimating its cost, so as to enable bidders to make intelligent bids for the work and thereby invite a healthy competition among contractors. City of Chcago v. Russo, 339 Ill. 349, 171 N. E. 523.

Municipality May Maintain Stadium as Public Building

It has been uniformly held that a municipality has power to construct a public auditorium, being designed to promote the education, amusement and inspiration of the public. For the same reason, the Ohio Court of Appeals holds, Meyer v. City of Cleveland, 35 Ohio App. 20, 171 N. E. 606, that a stadium is a public building within the power of a chartered municipality to construct and maintain.

Interest of City Official in Contract—Lowest Responsible Bidder

Under the Pennsylvania statute of June 27, 1913, P. L. 568, forbidding a member of the council of a municipality to vote on a matter in which he "has a personal or private interest," the Pennsylvania Supreme Court holds, Wilson v. City of New Castle, 301 Pa. 358, 152 Atl. 102, that the "interest" in a matter which will disqualify a public official acting in an executive capacity must be certain, pecuniary, or proprietary, and capable of proof. It must be direct, not possible or contingent, nor depending on an indirect benefit, as that contract may or may not affect other independent transactions. A sentimental interest or general interest is not enough. In short, "interest" must be reduced to a financial one coming directly to the public officer or to the company of which he is an officer.

Under the Act of May 27, 1919, P. L. 310, requiring municipal contracts to be given to the lowest responsible bidder, the term "lowest responsible bidder" does not mean that such bidder is merely pecuniarily responsible to carry on the work. The word "responsible" includes a number of things. It contemplates promptness, faithfulness and the capacity and ability to do the work according to the plans and specifications; men of skill must be employed in and about the work. The powers which city officials exercise are deliberative and discretionary; in the absence of evidence tending to show bad faith or corrupt motives, the award of a contract to a higher bidder, after an investigation, should not be stricken down.

Construction of Street Maintenance Provision by Iowa Courts

Under the Iowa statute, Code 1924, section 6003, providing that "all contracts * * * shall contain a provision obligating the contractor and his bondsmen from the time of acceptance by the city to keep in good repair said street improvement for not less than four years," the Iowa Supreme Court holds, Charles City v. Rasmussen, 232 N. W. 137, that the statute measures the liability of the contractor and his bondsman on the statutory bond. Any additions to the bond will be treated as surplusage, and any omission of the provisions of the statute will be read into the bond. The Iowa court's construction of such bonds is that the contractor and his bondsmen are not liable for ordinary wear and tear, brought about by the use of the street for ordinary purposes. In other words, if the contractor furnished the material and workmanship, and the pavement were laid in all respects as provided for by his contract, then he would not be liable for defects occurring in the street arising solely from its use for ordinary traffic; and, conversely, if the ordinary use of the street resulted in necessary repairs by reason of defective workmanship or material, then he would be liable. The fact that the contract provided that the contractor guaranteed that the improvement should be and remain in first class condition, true and even surface, would not make the contractor liable for ordinary wear and tear.

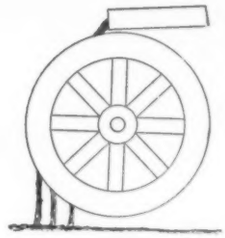
City Not Liable for Excess of Engineer's Estimate for Public Work Under Statute

A contract not in its origin obligatory upon a municipality by reason of not having been made in the manner prescribed by law, cannot be affirmed or ratified in disregard of that statute. Oklahoma C. S., §4577, requires the city engineer to make an estimate of the cost of any proposed public improvement and provides that no contract shall be made for a price exceeding the aggregate amount thereof. The Oklahoma Supreme Court holds, Smith v. City of Tahlequah, 291 Pac. 981, that this section is applicable to a contract entered into by a city council for the erection of a municipal light plant and when it was established that the city had paid to the contractors on their contract an amount equal to the engineer's estimated cost of such work, the city was not liable for any further sum.

Alterations Not Sufficient to Relieve Surety

Additions or alterations made by the contractor at the request of the board of education of a school district, without written authorization by the architect as required by the contract, amounting to less than 4 per cent of the original contract, were held not so extensive or material as to be a departure from the original contract, within South Dakota Rev. Code 1919, § § 1491, 1504, so as to release the surety from a statutory bond from liability to one furnishing material which was used by the contractor in the building. Independent School Dist. No. 41 v. Sloan, 224 N. W. 182.

THE WATER WHEEL



By
Jack J. Hinman, Jr.

The essential features of important articles of the month having to do with water works designs, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

SINCE all of our water supplies, whether from surface sources or from underground reserves, depend so completely upon replenishment by rainfall, it is no wonder that papers on the lessons of our recent experiences with the **drought** continue to appear. And it is natural also to wonder if we have learned all that we should from our own troubles and those of our neighbors. Some organizations have had the effects of expensive emergency installations heightened by the financial stringency of the depression in most serious measure. It is small wonder then that such papers as those of Knowles[99] and Veatch[152] continue to find their place in the magazines, nor that studies of **stream flow,** such as that of Ray[79] for North Carolina streams are attracting even more attention than usual. Insufficiency of rainfall records has prompted authorities to begin the accumulation of data in their own localities and to depend less upon the records of nearby places. Hence there is more interest than usual in **instruments for measuring precipitation**[127] and in the amount of run-off to be expected[108]. Investigations started in 1925 by the U. S. Bureau of Mines on the **acid drainage of coal mines**[163] have yielded information which was valuable under conditions of low stream flow and have pointed to the benefit of the sealing of mines which have been temporarily or permanently closed down. A considerable number of states have conducted studies on their stream pollution problems under the unusually favorable circumstances of extreme concentration of polluting materials shown in localities which were affected by the drought. Tennessee has congratulated herself upon the condition of her streams[n71]. Cooperation of communities and industries for the **safeguarding of streams** used by them is a thing to be desired. For this reason the work of the Upper Potomac Rivers Board should be considered one of the more wholesome and reasonable steps on the way to effective stream conservation[101, 144].

Construction

Work on the Hoover Dam progresses though handicapped to a certain extent by the floods which occurred in the Colorado river during February[16, n35, n43 n49]. Very interesting methods were used to handle the **concrete** at a dam site near Wilmington, Delaware[27]. In this case the cement, to the amount of three to four cars per day was delivered in bulk and blown 3000 feet to the mixers. In the Italian Appenines a leaking storage reservoir was sealed by the application of a coating applied by the **cement gun**[41]. The **impounding reservoirs** in the Ruhr valley are providing the residents with a holiday resort as well as a storage of water according to Fair[7].

Methane encountered in the Mitchell shaft of the Hetch Hetchy aqueduct was responsible for a gas explosion which cost twelve lives. A rigid **safety program** has been laid down and every effort is being taken to ward off another similar accident[102]. New York City's twenty mile tunnel known as **Aqueduct No. 2** was holed through on February 22nd[n48].

A vast mileage of **pipe lines** was laid in 1931. The oil and gas industry put in more than fifteen thousand miles of trunk lines, of which about 75% was for gas[n46]. Many water lines were also laid. Some of these lines were of emergency nature and constructed under great stress. The emergency seven mile pipe line to the Kentucky river laid at **Lexington, Kentucky,** by the Community Water Service Company was one of the lines installed with great haste in spite of severe obstacles[122]. **Hattiesburg, Mississippi,** put in 34,000 feet of 20 inch cast iron pipe to bring in the water of flowing wells along the Bouie river[123].

In cities the location of underground piping and conduits is often very confused both on account of the numerous and complicated connections and because the older lines were often laid without a definite plan or indeed without any record being made of their location. Consoer[25] suggests that a definite plan for the **location of underground utilities** should be arrived at by a central planning body financed by all organizations concerned and beyond political control or interference. Permits should be issued by this central body and records should be kept of all kinds of underground work.

Services and piping at El Paso, Texas are rapidly destroyed in certain sections of the city. **Red clay** areas seem to be most objectionable. Galvanized steel and galvanized wrought iron pipes last but a few years. Cast iron piping undergoes the socalled "graphitic softening" and can be cut with a pocket knife or chopped with an axe. Woods[142] says that copper service pipes have not been destroyed in three years of use. Murenberg, Germany,[69] has apparently had somewhat similar trouble with cast iron piping. On the other hand eighty-year-old **cast iron pipe** has been found as good as ever in the Chicago system. Cement-lined cast iron pipe has been coated with bitumen by New York City[26] with the idea of increasing the life of the cement lining and the prevention of hardening of the water when the pipe has newly been laid. **Coatings** have also been applied to steel pipes in Germany as described by Weckwerth[57]. **Welded** joints in piping and in the repair of hydrants have also been used in German practice [60, 63].

The use of **elevated tanks** to secure more uniform service in outlying sections have been studied in Milwaukee[86] and in Indianapolis[6]. In the latter city a 1.5

million gallon tank of the **Horton radial cone-bottom** type[37] has been built for a section in the eastern portion of the city. Columbus, Ohio, is to have a 2 million gallon tank of this type. Lindsay[39] describes a water tank designed especially to resist **earthquake shock.** The supporting system consists of a series of rectangular cells twelve feet square in plan. A sixteen inch slab, 84½ feet from the ground level carries the 1,250,000 gallon tank. An outer concrete shell of pleasing appearance rises to 122 feet 8 inches. The Indianapolis tank has special electrical devices to control its **water level.** The equipment is described by Rupard[38].

In an effort to conserve **ground water** New Mexico is to plug leaking wells in the Roswell artesian basin[45]. Calvert[88] tells an unusual story in connection with the pollution of the two wells of the Indianapolis Sanitary District plant by **impounded garbage liquors.** The ways in which ground waters have become polluted and caused epidemics in a number of communities are detailed by Eastwood[4] who insists that all **untreated ground waters** are potential hazards. It is always surprising how frequently the matter of **water divining** is discussed, not only in this country, but also in France and Germany[69]. **Latham,** New York[153] has a new artesian well supply, while **Bermuda**[116] will get water from what has been described as a horizontal well. At a recent national convention of water well drillers, the business phases of **well drilling** received considerable discussion in the hope of bettering conditions[75, 77].

Papers of Special Interest

Designing **dams** for economical increase in height, Davis[40].

Discharge of water thru dams and pressure tunnels, Ball[n31].

Turbo Centrifugal units, Thompson and Lawlor[82].

Nomographic chart for **determining tank contents,** Schaphorst[133].

Making a **shut-off** in well construction[n78].

Automatic pumping stations in German practice, Schimrigk[56].

Design of **pipe systems,** vonGronow[65].

Plant Descriptions

Grand Canyon National Park proposal[n150]; **Watertown,** N. Y., Hale[85]; **Leroy and Ticonderoga,** N. Y., Wells[87]; **Essex Border District,** Canada, Strickland[81]; **Regina,** Sask., Wynne-Roberts[83]; **Bermuda**[n42]; **Bakewell** Rural District Council, Derbyshire, Marsland[130]; **Morriston,** Elginshire, Scotland[135]; **Newbury,** Berkshire, Bowes[128]; **Nottingham**[129]; **Paris** extensions[44]; **Paderborn,** Germany, Lauenstein[58]; **Salzburg,** Germany[62]; **Capetown,** South Africa, Lloyd-Davies[32]; **Rand** Water Board, South Africa, Mason[137]; **Rangoon**[120].

Water Purification and Operation

Weston[94] traces the development of **water purification practice in New England.** Nasmith[22] gives a short statement of the principles and accomplishments of water purification. Recent developments in water purification form part of a report on the status of the art of sanitary engineering by Pearse, Dixon and Stevenson[24]. At the New England Water Works Association meeting much interest was expressed in comparison between **English and American practice**[164]. W. Gordon Carey continues to discuss American practice as reflected in the Journal of the American Water Works Association for the benefit of British readers[134]. Applebaum explains the water needs of the **textile industry** and the water purification requirements which result[140].

Baylis[139] reviews the recent studies on **filter sands** and discusses the need of additional investigations. Meyer[53] describes the removal of organisms from a sand filter. He was bothered by the diatom Asterionella and used chlorine to get rid of it. Carpenter[146] has made a study of the deposition of **manganese** in filters and recommends that the pH of the water be raised to 8.3, at which point the manganese will be precipitated in the settling basins and will not reach the filters to deposit on the sand grains. The **Lakhovsky filter** is a porous filter treated with silver chloride and baked at 2200°F.[n115, n159]. It is claimed that water passed thru this filter contains no silver but possesses a residual germicidal power. **Iron** in combination with **humic acids** gave difficulty at Delmenhorst, Germany, according to Franke[54]. Aeration alone did not produce so satisfactory an effect as when followed by passage thru a coke tower or rieseler.

Taste and odor removal continue to attract the attention of the water works operator—as they probably always will. Warrick and Muegge[84] review the attempts which have been made to remove odors and tastes from drinking waters. Forman[113] does the same with special attention to New Jersey experiences. Lyles[89] describes the use of aeration for removal of **hydrogen sulfide** and the use of **ammonia** in combination with chlorine to destroy swampy tastes at Tampa, Florida.

Corrosive water from the Wanaque reservoir which caused difficulty in Montclair N. J.[155] was corrected by adding sufficient lime to remove the free carbon dioxide and raise the pH to 7.8 or 8.5. At Fort Valley, Georgia[158], aeration was combined with sufficient lime to raise the pH of well water from 5.2 to 8.4.

Howson[80] describes the **Cedar Rapids, Iowa** water softening plant. The cost of salt in the **zeolite** water softening plant of Sewickley, Pennsylvania, approximated $1.61 per grain of hardness removed per million gallons, with salt at $8.50 per ton[n151]. The use of **sodium aluminate** as a coagulant especially adapted to water softening plant practice is discussed by Holmes[105]. Foulk and Hansley[76] have conducted a valuable series of experiments on **boiler water foaming** at atmospheric pressure with particular reference to floating solids and oily scale. Ryan[106] explains the fundamentals of **boiler blowdown** regimes.

Articles of Special Interest

Aero-O-Mix in Canada, Foreman[21].

Use of **freezing** to make pipe repairs, Scholl[61].

Experiences with **filter plant troubles,** Williams[168].

Filter plant for **E. B. Eddy Co.,** pulp and paper plant at Ottawa, (Ont.)[17].

St. Catherines, Ont., filter plant report[n18].

Boiler water hydrometer called **"Test-O-Meter"** devised[n107].

Cooling drinking water in quantity, Dienert[121].

Papers on Operation of Filter Plants

Cambridge, Mass., Whipple and Smith[95].

Greenwich, Conn., Chandler[97].

Hartford, Conn., Gentner[98].

Providence, R. I., Bean[96].

Management and Financial

Daniel[167] in a practical paper lists a number of objectionable features which he has noted in water works systems. The four first points are: (1.) A "penny wise pound foolish" attitude; (2.) Insecurity of tenure of superintendent; (3.) Appointment of unqualified superintendent; (4.) Unsatisfactory record systems. The Michigan State Department of Health has sought to insure the employment of qualified operators by

(Continued on page 50)

THE EDITOR'S PAGE

Depression—or Reconstruction

The period through which we are passing has been called a good many things—most commonly and most politely, perhaps, a depression. But in a larger sense it is a reconstruction, a facing of new facts and a finding of new ways to do things. There will be no magic by which the easy times of the past can be restored. It is not possible merely to wait for the appearance of that more or less mythical corner we hear about. Each one of us must find that corner for himself. When the million or more businesses, small and large, which make up the total of American business, have been put upon sound and solvent bases, then will all American business be on a sound and solvent basis, and our reconstruction period will be over.

The lesson has been, and continues to be, a hard one. It must be learned by each one of us, whether we be engineer, official or contractor. And that lesson consists not simply in learning to spend less money, but in learning to spend it more wisely and more efficiently. The consulting engineer must make use of latest equipment and methods in design. The city, county or state engineer must learn new methods of constructing and maintaining roads that will yield better results in transportation with less expenditure. The progress along this line has been most gratifying. Manufacturers have brought out more new equipment designed to meet these conditions than in any previous year, we believe. A glance at pages 61 and following in this issue will give some idea of the new equipment that has been designed for meeting 1932 conditions. Low-cost road development has produced more real progress than in the five years preceding.

The contractor also must take into account the lessons of the past two years. The going has been hard, and it will continue to be hard to those who have not appreciated what the changed conditions in the construction industry really mean. Cost competition is more than likely to be intense, and this can be met only by the employment of the machinery and methods best adapted to securing maximum efficiency of labor and equipment on the job in question.

In this issue are two valuable articles which show the way to more profits in the construction field. The lessons they carry may be summed up in a few words. Better management and more intelligent attention to each detail of the work will result in a greater output per machine; and the use of balanced equipment of the most modern type will still further greatly reduce costs. Of the two, management is probably the most important, but a contractor working antiquated machinery is working under a tremendous handicap. Last year and the year before, contractors put off buying new construction equipment. Working that equipment another year means paying an overhead of 10%, 20% and in some cases 30% in lost time, repair bills and inefficiency of operation.

Public Approval of the Gasoline Tax

"During 1930 approximately $15,500,000 in gasoline tax money was diverted to purposes that had no relation whatsoever with roads or with motorists as a group. The strangest use of gasoline tax money occurs in an eastern state. Last year that state paid out $75,000 of gasoline tax money to the State Department of Conservation for oyster propagation. More than one-fourth of the gasoline money collected by a southern state in 1930, $3,780,000, was diverted to the erection of school buildings and the support of schools. In another state in the south $2,200,000 of gasoline tax money went for the same purpose. In another state it is possible to levy the gasoline tax only under the constitutional provision of occupational taxes, which means that one-fourth of the gas tax money must be paid for schools. Consequently around $7,000,000 of gasoline tax money collected from motorists in that state yearly goes into state school funds."

These statements were made recently by Frederic E. Everett, president of the American Association of State Highway Officials. The point he makes is one of several connected with the general matter of the gas tax that needs attention.

Insofar as a tax can be popular and painless, the gas tax was so considered by automobilists during its first few years. Two cents and three cents were accepted with little grumbling; but five, six and even seven cents in some states has caused opposition which may be more or less warranted. Even this high tax would, however, be accepted with resignation, we believe, if it were all spent, with reasonable economy and efficiency, on highways. But why should citizens be required to contribute to oyster propagation, or even to the state education fund, in proportion to the use they make of the highways? Diversion of gasoline tax funds to uses not connected with highways will be looked upon as an injustice; and American taxpayers are apt to find ways of demonstrating their resentment at unjust taxation—ask Chicago officials, they know.

There is another viewpoint; high taxes tempt evasion, and so-called "bootlegging" of gasoline has come in with high gas taxes. Both the state authorities and the gasoline companies are asking automobile users to aid them in suppressing this by refusing to deal with gasoline bootleggers. But if the users find that the gasoline taxes are not used for highway work, they will not be enthusiastic in giving such aid. What results from a large part of the citizens believing taxes or laws are unfair is demonstrated by the popular feeling toward bootlegging of liquor in many sections.

If state officials expect the gasoline tax to be paid as freely and fully as it was at first, and still is to a large extent, they must use the proceeds from it solely for the benefit of road users, in the construction and maintenance of highways.

Solving Problems in Street Design

By D. Y. Bate
Junior Civil Engineer, City of Los Angeles, California

This is one of a series of articles by Mr. Bate (and others) devoted to the solution of practical field and office problems of city engineering. Readers are invited to contribute short cuts, time saving methods and interesting solutions to this series.

1. This problem is met in the design of curvilinear streets where a vertical curve extends off the horizontal curve on to the horizontal tangent; also where reverse curves are encountered. On reverse curves it is most frequently encountered as the radial lengths change at the point of reversal.

In this method the rate of grade between points A and B is multiplied by the distance from either end to the vertex, and the elevation of C determined. The correction for M is found by the usual method, i.e., $M = V - \frac{V + C}{2}$ Calculate each portion of the curve as a simple parabola. It is simply two parabolas tangent at the vertex.

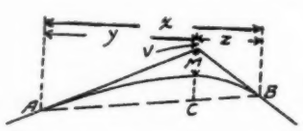
This method is shorter than the theoretically correct one, but the difference in final results is too small to plat, therefore can very well be disregarded as too small to be of any value when constructing.

2. This problem is met where cross-fall and drainage are encountered on a street. By its solution the distance out from the curb to which water will extend is ascertained, and also a check against a design which will allow water to spill over the crown. From the drainage standpoint, the area of the waterway can be ascertained.

3. This problem is encountered a great deal in laying grades and resolves itself into the solution of the triangle DVB. It is the amount of divergence between two grades at a given point divided by the total rate of divergence, which gives the distance from the given point to their intersection.

4. The solution of this problem allows for the location of the low point in a vertical curve so that a drainage outlet may be located to take all the water and not leave a pocket.

1. Vertical Curve with Unequal Tangents (Compound Parabola)



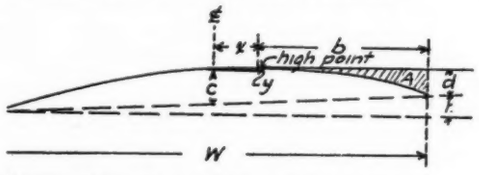
Given: Elevation at A, B, V.
Grade Rates AV. BV.
Distances x, y and z.

Elevation $C = A + (\frac{B-A}{x} y) = B - (\frac{B-A}{x} z)$

Mid-ordinate $= V - \frac{V-C}{2}$

Starting at A, calculate common parabola to V. Starting at B, calculate common parabola to V. This gives portions of two parabolas with common tangent at V.

2. To Find High Point in Street Crown; Also Area Holding Water on the High Side of the Street (Walker)



x = distance from CL to high point on crown
c = height of crown in feet
h = cross-fall -- difference between gutter elevations
w = width of roadway between gutters
d = height to which water will rise on curb
y = difference between elevations at CL and high point
b = distance from curb to which water will extend
A = area of section carrying water

$k = \text{constant} = \frac{h}{8c}$ $x = kw$ $y = \frac{1}{2}kh$ $A = \frac{bd}{3}$ = area of $\frac{1}{3}$ of parabola.

When $c = 0.00125w$, then $x = 10h$.

3. To Find Vertex of Intersecting Grades.

Given: Elevations at A & B, L = distance between A & B in feet, grade rates AV = A' & BV = B'.

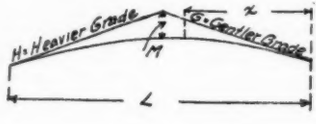
Produce A' to D. D = A+(A'L)

$\frac{D-B}{\text{Algebraic diff. A' \& B'}} = y$

Example.

A = 92.5	D = 92.5+(12.5% x 100)=105.0	40x10.0% = 4.0
A' = 12.5%	D-B = 105.0-96.0 = 9.0	96.0+4.0=100.0=Elev. V.
B' = 10.0%	A' = +12.5% B' = -10.0%	100-40 x 12.5= 7.5
B = 96.0	12.5%-(-10.0%) = 22.5%	92.5+7.5 = 100.0
L = 100.0	9.0 ÷ 22.5% = 40.0 = y	or Elev. V. Check.

4. To Find Sag or Peak of Vertical Curve.



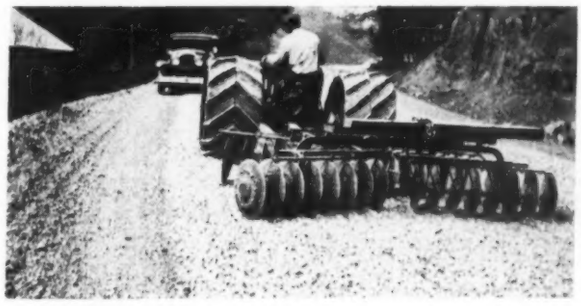
M = mid-ordinate of vertical
G = lesser or gentler grade
H = heavier or steeper grade
L = horizontal length of curve
X = distance from BC of gentler grade to sag or peak.

$X = \frac{G}{(G+H)} L$

HIGHWAYS

and

PAVEMENTS



Surface Treatment Methods and Results in New Hampshire

EXCELLENT results have been secured through low-cost surface treatment methods in New Hampshire. It has been found possible to maintain surface-treated gravel roads at a cost of $500 to $600 per mile per year, or even less. By the use of the honing method it has been found possible to maintain these roads with a very satisfactory riding surface, as well. Roughometer readings have shown a decrease of 30% to 50% in roughness over ordinary surface-treated roads, and in many places the readings approach those secured from well-constructed concrete roads.

In general, the methods are similar to those used in Maine, which were described in the August, 1931, issue of PUBLIC WORKS. In both states conditions are much the same in character—large mileages of roads are subject to heavy travel during a few months of the year; resources are limited, and it is not possible to construct any considerable amount of hard-surface roads. The methods by which these difficulties have been so satisfactorily overcome should be of value to many other road builders faced with a like problem.

Tar of 18-25 viscosity has been used generally in the work in New Hampshire. This is furnished mainly by The Barrett Co., Koppers Co. and the Public Service of New Jersey. Some asphalt has been used with satisfactory results and it is likely that more will be used in the future. The gravel is bank run, unscreened, consisting mainly of coarse sand with some pebbles. This is loaded by hand or by loader, depending upon the size and importance of the pit, and hauled by locally hired trucks.

A road in the New Hampshire mountains

When treating a road not previously surfaced, two applications are given. The first treatment consists of about 0.4 gallon of tar per square yard, after which the gravel is applied, using from 50 to 75 cubic yards per mile. Not much honing is done on this application. Following this treatment, a second application of 0.2 to 0.25 gallon per square yard is given, with another application of about the same amount of gravel. The gravel has been spread mostly by hand, but on some jobs a spreader has been used. An advantage in the use of the spreader is that a smaller amount of gravel is required, generally not more than two-thirds as much as when hand spreading is used.

The covering is applied just as closely after the distributor has put on the tar as is possible, in order to minimize discomfort to the traveling public. Following the covering, the road is dragged, using a hone or drag about 10 feet long, which is essentially the same as that used in Maine, and the methods are about the same. The road is dragged once each way, turning the material toward the sides, and twice each way turning the material back toward the center. A final light back cover of sand is then applied.

A larger drag, one approximately 18 feet long, has been tried out. It has been found possible to reduce the number of trips to 4, instead of the 6 required with the shorter drag, and there may be some advantage in securing better riding qualities, but a larger truck is required for hauling the longer drag, and it is harder to move from one job to another.

On recoat work, the same procedure is followed, using ¼ to 1/5 gallon per square yard, and 50 to 75 yards of gravel per mile.

The costs of the work average around $500 to $600, with a minimum of $400 per mile for recoat work, that is, work after the first year; and about $1,000 per mile for the initial double application treatment. These figures relate to 18-foot roadways.

In the southern part of the state, surface treatment work begins in May and is generally completed by the middle or latter part of July. New work is sometimes done in the fall.

The state is organized with ten divisions, in each of which there are several drag crews. These normally comprise about 20 men each, and are, in many cases, recruited locally. No camps are maintained,

the men living at home. Trucks are hired locally.

Frederic E. Everett is State Highway Commissioner. The work described in this article is under the direct supervision of J. W. Childs, deputy commissioner.

Tractor Does Double Duty Bulldozing and Hauling

Using a tractor equipped with a bulldozer to haul a crawler wagon proved successful on a job in Wisconsin. The contractor was M. A. Leiberg of Oldfield, Wisc., and the job involved grading work on trunk road AA of Fond du Lac County. Mr. Leiberg used three "35" Allis-Chalmers tractors, one of which was equipped with a bulldozer, and three 7-yard, direct-hitch Western crawler dump wagons. He found that the tractor equipped with the bulldozer could

Outfit used by F. C. Bretz, caterpillars and Austin wagons

make trip for trip with the other tractor-crawler wagon units, while pulling a loaded wagon, and could spread the material which had been dumped by the other two units as well as its own. Except when spreading, this bulldozer-wagon combination operated in either high or second.

On this job Mr. Leiberg also found that the tractors were amply able to handle the crawler wagons, and that there was no advantage in using larger tractors, since the smaller tractors were speedier and showed somewhat greater yardage.

On a contract for grading 5½ miles of U. S. Highway No. 169 in Humboldt Co., Ia., F. C. Bretz, of Ayershire, Ia., operated a tractor and crawler wagon outfit. The contract involved 122,000 cubic yards of very heavy grading. The material was almost like concrete, and had to be blasted or loosened with a rooter plow. Mr. Bretz put six crawler tractors on the job—one on an elevating grader, one on either a rotary fresno or a rooter plow, as needed, and four on four Western crawler dump wagons of 5 cubic yards capacity each. These wagons were equipped with a spring wind-up, which allowed the tractor driver to dump and close the doors without delay. The aveage haul was 700 feet.

Truck Mixed and Central Mixed Concrete

More than one hundred city engineers inform us that concrete from central mixing plants was used in constructing their streets last year, and thirty-two that truck-mixed concrete was so used.

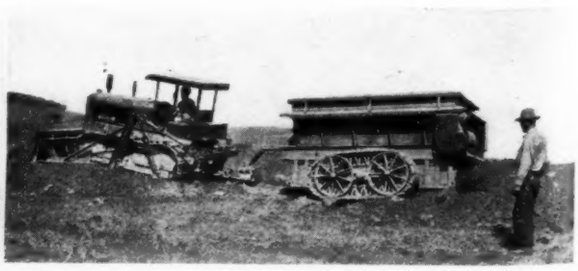
Central mixing plant concrete seems to be especially popular in the Middle Atlantic, East North Central and West North Central sections of the country, from which its use was reported by 23, 23 and 20 cities respectively. Seven cities so reported from New England, 14 from the South Atlantic, 6 from the East South Central, 11 from the West South Central, 4 from the Mountain and 11 from the Pacific. Of this total of 119 cities, 76 found it "satisfactory," "O.K.," "good" etc. Seven were dissatisfied with it, and 36 were enthusiastic in its praise.

Among the comments on central mixed concrete were: "Excellent concrete; but trucking on the subgrade necessitated retrimming." "Best we have." "Not so good for long hauls." "Found trouble in handling by loss of water and segregation." "Trouble with segregation and difficulty in getting it from truck." "Strength less, and less uniform consistency." "Requires close control of consistency to avoid segregation." "Very satisfactory if water ratio is handled carefully." "Ideal." "Very satisfactory; in one case where 1.70 bbl. of cement per cubic yard was required, 1.69 was found to be actually used." "Less confusion on the street." "Great improvement; stronger, more uniform, clean concrete." "Less waste; more accurate measuring." "Ideal for small jobs." "Better mix, easy to get water, better control of materials."

The use of truck-mixed concrete was not nearly so general. Only 32 cities in all reported it, 5 in New England, 12 in the Middle Atlantic, 2 in the E. S. C., 7 in the E. N. C., 1 in the W. N. C. and in the mountain, and none in the South Atlantic, W. S. C. and Pacific states. Of these 32, 7 found it very satisfactory and 1 unsatisfactory. Several cities use it only for curbs, gutters or sidewalks, repairs and "small jobs." "Best we have." "More uniform and stronger concrete." "Exceeded the test requirements." "Good strength and uniformity." "There are two serious drawbacks—getting the concrete from truck to street (the use of a chute is never satisfactory, especially when reinforcement is to be used); and not enough control over the water content."

With less than 6 percent unsatisfied with this kind of preparation of concrete, which some may object to at first because of its novelty, and which, in other cases, may suffer from the inexperience of those in charge; it seems very probable that its use will increase and any objectionable features be largely eliminated.

M. A. Leiberg's tractor using bulldozer while pulling loaded 5-yard crawler dump wagon



Same wagon just after tractor driver pulled the rope that dumped the load.

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HOW many times, during a long, dry season, have your blader crews waited patiently, day after day, for rain? How much valuable time has been wasted? How much damage has been done to the road? How much of the road surface has blown away?

Take a tip from hundreds of fellow highway maintenance men. Use Calcium Chloride, the clean, odorless, non-tracking dust preventive. The small flakes absorb moisture from the air and keep the road surface in workable condition regardless of dry weather.

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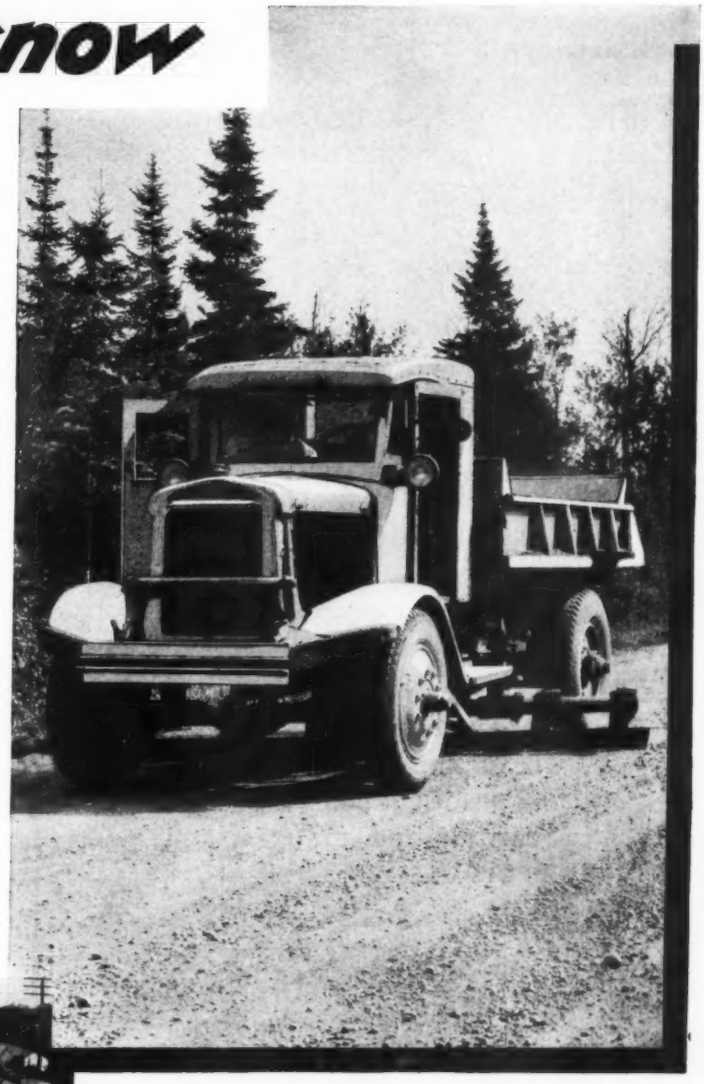

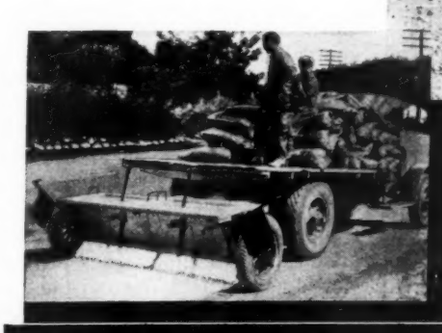

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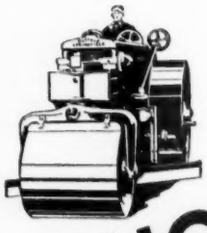

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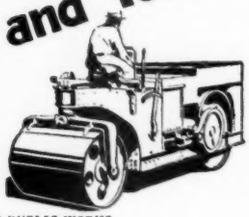

When writing, please mention PUBLIC WORKS

How to Establish Rental Rates for Road Equipment

Items that enter into a determination of the proper rental rate to establish for highway equipment as reported by a joint committee of the American Road Builders' Association and the American Association of State Highway Officials at the 29th Annual Convention and Road Show in Detroit, are as follows:

Operating Charges. (a) Average cost of repairs and upkeep; (b) Operation expense, fuel, oil, etc.; together with

Fixed Charges. (a) Operating depreciation; (b) Idle depreciation; (c) Interest; (d) Taxes; (e) Insurance; (f) Profit; (g) Overhead, storage, administration.

Note.—Items (c) to (g) of the fixed charges apply only if the equipment is privately owned.

Annual depreciation on a $600 machine with a life of five years and a scrap value of $100 at the end of that period is given below, as computed by three methods:

Years	Straight line	Diminishing value	Sinking fund 6% interest
First	$100	$180.72	$ 88.70
Second	100	126.28	94.02
Third	100	88.25	99.66
Fourth	100	61.67	105.64
Fifth	100	43.08	111.98
Totals	$500	$500.00	$500.00

The value of service with respect to having equipment ready when needed must be considered for each special case.

Depreciation is both natural, as consumed in production work, and functional, due to obsolescence or inadequacy.

The adoption or use of established rental rates may by debarred by law in acquiring equipment for a state, but a consideration of such rental rates will furnish information useful in cost accounting, according to the committee report.

Pavement Finishing Machines

Finishing machines are now standard equipment in constructing concrete highways and are coming into use for bituminous ones. But their use is not so general in cities, chiefly because of the difficulties of using them in streets where abutting curbs and sidewalks present difficulties.

In a recent questionnaire to city engineers we asked: "Do your specifications cover the use of a finishing machine on cement concrete pavements? On bituminous surfacings?" Of about eight hundred who replied, 152 reported "yes" for concrete pavements, and 18 for bituminous. Ten of the 18 bituminous were in the Pacific states; the others in the E. N. C., W. N. C., and W. S. C.

Of the 152 using it for concrete, 56 were in the E. N. C.; 26 in the Middle Atlantic; 14 in the Pacific states; 12 each in the New England, South Atlantic and W. N. C.; and the rest scattered through the other districts.

Several cities stated that the use was optional; others that it was used where possible. One reported it could not be used because of variations in widths and curb elevations. Another used it for 18-foot widths.

Resurfacing A State Highway With Brick

Resurfacing with brick salvages the old pavement . . . leaves subgrade undisturbed . . . gives lowest upkeep and longest life of any material . . .

SOMETHING *has* to be done with a road when weathering action and traffic wear boost upkeep costs and interfere with travel.

When this happens the practical thing to do is resurface with brick.

An old pavement makes a good base. Underneath it is a settled subgrade that, undisturbed, is a valuable asset. With a minimum of cost the old pavement is prepared for the brick surface and then you have the finest road in the world.

Brick is undisputed as the pavement with the lowest maintenance. For length of service, no other pavement comes near it. A vitrified brick surface resists damage from weather as well as traffic. It preserves the base and allows it to perform its structural function.

The National Paving Brick Association will gladly furnish data and descriptive information on resurfacing to those desiring it. The address is 1245 National Press Building, Washington, D. C.

A good pavement after 42 years is Whittlessey Ave., Norwalk, O. Maintenance cost—practically none.

***use the old Pavement . . . . . resurface it with* BRICK**

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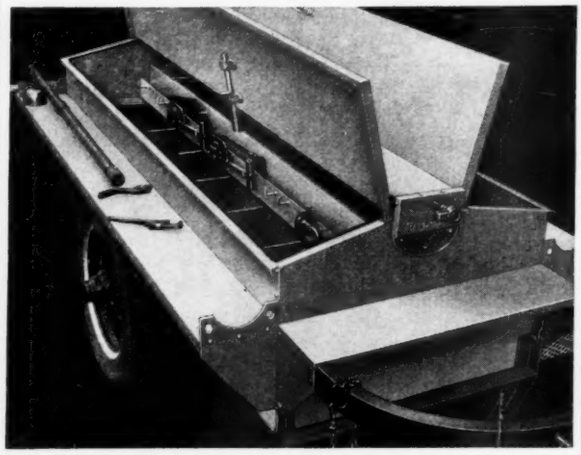

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Water-Cement Ratio and Other Proportioning Methods

The use of the water-cement ratio has been advocated and received much publicity, but how general its actual use is has not, so far as we know, been actually ascertained. To get some idea on this point we asked city engineers "In what classes of work, if any, do you use the water-cement ratio in proportioning concrete? What other methods of proportioning concrete (other than the fixed numerical proportion) do you use, and on what classes of work?"

About eight hundred replies were received. Of these, 207 reported using the water-cement ratio, or about 25 percent. One hundred and three use it for pavements and bases; 73 for all work; 7 for bridges; 4 for water works reservoirs; 11 for special work such as sewage treatment plants, concrete sewers, etc. The remaining failed to specify the use.

Among the qualifications of uses were: Pavements but not sidewalks. Where water tightness or uniform strength is wanted. Two use it for all work "except minor repairs."

Other proportioning methods or tests used are: Slump test—8. Specifying amount of cement per cubic yard of concrete—8. Fineness modulus—7. Specifying strength of resulting concrete—4.

Mixing Concrete for Brooklyn, N. Y., Streets

The Bureau of Highways of Brooklyn, N. Y., requires that all concrete used for one-course concrete sidewalks or for pavement foundations (except built-up concrete where a street is being repaved and the old foundation is left is) be subject to a test for strength. In such cases the amounts of water, cement and aggregates are not specified, being left entirely to the judgment of the contractor, who is paid only a proportional part of the price bid if the concrete is deficient in strength.

In the case of other concrete the specifications call for a 1-3-6 mix for pavement foundations and a 1-2-4 mix for curbs and two-course sidewalks; with not more than 6 gallons of water per bag of cement.

The use of truck-mixed and central-mixed concrete has been satisfactory, as almost all of this that has been used in Brooklyn has been paid for on the basis of strength, as described above. Where not so paid, it is necessary to have an additional inspector at the plant or on the truck, or both, in addition to the one observing the placing on the street, which is an added expense.

Horses for Refuse Collection

Harrisburg, Pa., uses horse-drawn equipment for collecting garbage, rubbish and ashes, most of it owned by the city. Each spring six or eight horses that are footsore or have other ailments are sold at a good price, mostly to farmers, and quite a few of them regain some of their original vigor working on the farm. H. F. Sheesley, chief of the bureau, considers this an excellent plan, "as it gets rid of undesirable horses that we would have complaint of for being on our streets, as well as buying the same number of younger horses to take their places."

Note how clean, stone-free and tar-free, are the tire treads on this Road Hog grader, equipped with Goodyear Pneumatic Lug Tractor Tires

ONCE you see Goodyear Pneumatic Lug Tractor Tires at work on mulch resurfacing or repairing of highways, you will be quick to note their practical superiorities.

For one thing, their tread design is *self-cleaning*. This enables them always to bear down with *sufficient traction for a straight forward motion.*

This self-cleaning, with its consequent sure tractive power will be recognized by every experienced road builder as a real asset. It means power equipment on the road and at work, instead of slipping off and giving trouble.

Sidewalls, body and tread of

Goodyear Pneumatic Lug Tires are built to offer special resistance to oil-acid solutions and the abrasive cutting action of sharp surface rock.

A new Goodyear development—not merely a modified truck tire—they are designed to deliver long, economical, trouble-free wear on power grader service.

The Goodyear Government Sales Department, Akron, Ohio, or Los Angeles, California, or your nearest Goodyear Service Station Dealer will gladly furnish full information as to sizes and prices.

TUNE IN: Goodyear invites you to hear Arthur Pryor and his Band . . . Revellers Quartet and Goodyear Concert-Dance Orchestra . . . every Wednesday and Saturday night, over N. B. C. Red Network, W E A F and Associated Stations

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THE GREATEST NAME IN RUBBER

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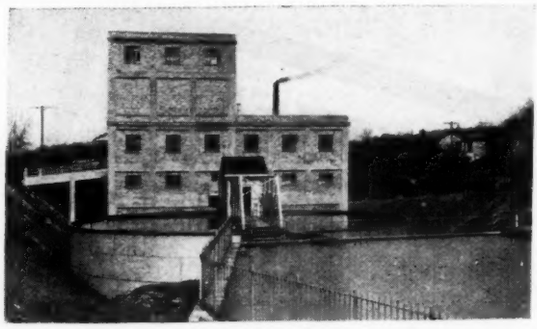
Sanitary Engineering



Some Principles of Sludge Bed Design

By F. B. Barns
Of Lord & Burnham Company

Orientation: Glass surfaces will reflect from 10 to over 90 per cent of the sun's rays, the amount of reflection depending upon the angle of incidence between the rays and the glass surfaces. It is therefore advisable to arrange the glass enclosed beds, whenever practicable, with the ridge of the building running east and west, so as to cause the sun's rays to strike the roof surface as nearly normal to the roof as possible during the greater part of the day. The maximum heat of the sun will thereby be made available for rapid drying of the sludge.

Foundations: Foundation walls, piers, and division walls between the individual beds should be kept as low as possible so as to minimize the effect of dense shadows that interfere with the drying of the sludge. High cross walls also interfere with the ventilating air currents. For best conditions, elevations of tops of walls should be kept within a maximum of two feet above the sand level.

Walkways: Walkways above the sludge beds should be constructed of galvanized steel grating supported on steel joists, so as to minimize shadow and interference with ventilating air currents. Sludge will not dry properly beneath wide, solid concrete or plank walkways placed close to the sludge surface.

Choice of Enclosure: Glass enclosures with interior columns are more economical than clear span types. This applies particularly to structures of greater width than 60 ft. Structures with columns also give more head room and should always be selected when overhead monorail systems are used for sludge removal.

In general, one large enclosure is not only more economical but more efficient in drying than a series of smaller individual enclosures placed side by side and separated by only a few feet. For beds over 60 ft. wide, the ridge and furrow type gives the best ventilation conditions.

Galvanizing: Due to the very severe conditions of alternate periods of excessive moisture and dryness, extremes of temperature and corrosive gases, all structural steel should be protected by hot dip galvanizing. Such coating is practically unaffected by the above conditions and the additional cost is less than the cost of once cleaning and repainting a painted structure.

Ventilation: Properly controlled ventilation is of prime importance in connection with the drying of sludge. Extensive tests indicate that side-wall sash should always swing inward so as to deflect the fresh air currents downward, causing the air to flow across the beds in contact with the sludge. If two lines of side-wall sash are employed, the upper line may be fixed or be swung inward; outward swung sash here interfere with the efficiency of ventilation. Ventilating sash in the gable ends are ordinarily of no value, as the entering air is drawn out at the ridge sash openings immediately above, without penetrating the building more than a few feet from the gable wall.

Sludge Removal Systems: When the monorail system of sludge removal is used, a clear height of twelve feet is required between the bottom flange of the track and the level of the roadway outside the building, in order that the dumping sludge bucket may discharge into an auto truck. This required clearance can usually be secured only in the interior column type of enclosure.

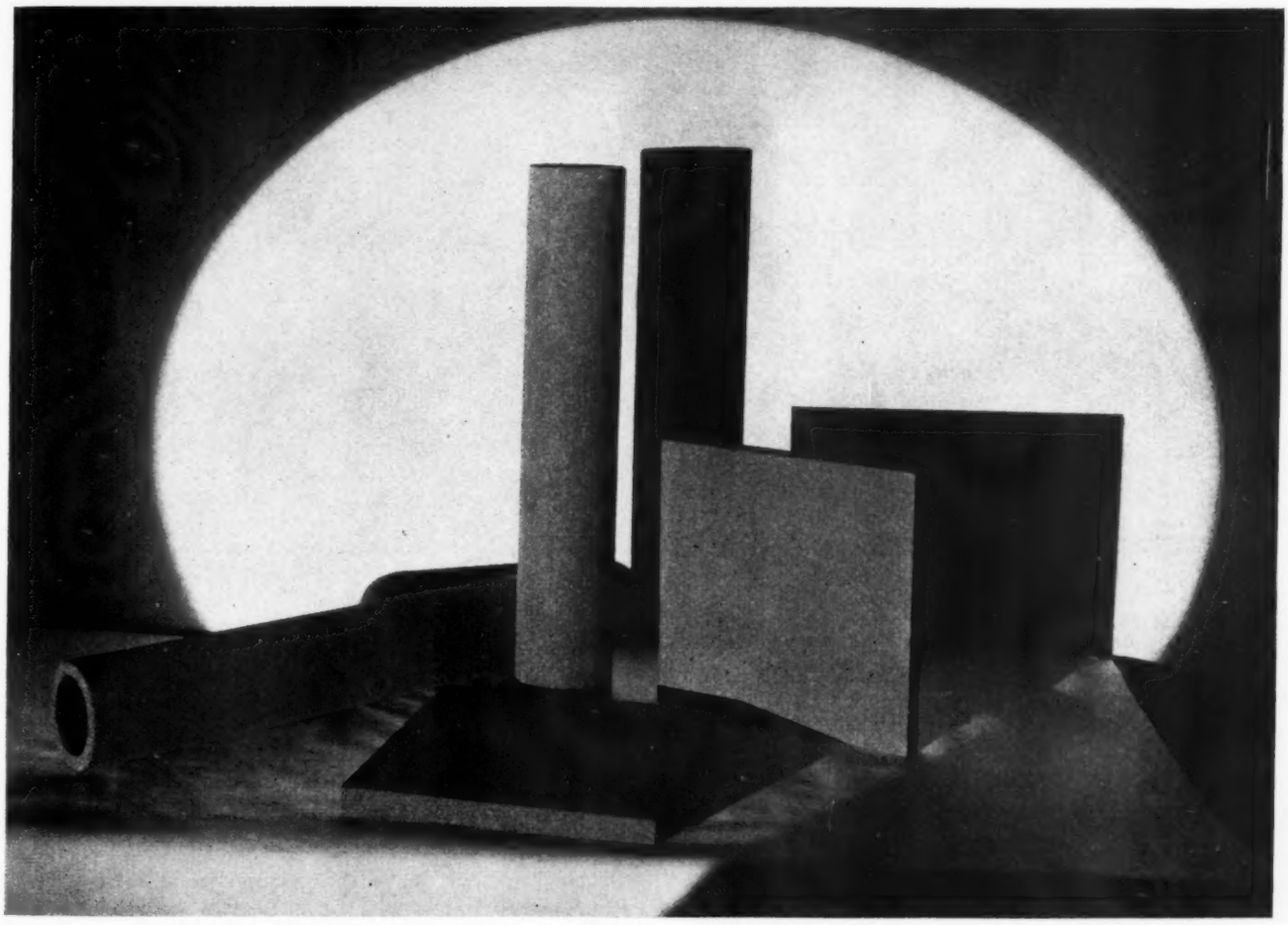
Where the narrow-gauge industrial car and track system is used for sludge removal, the track may rest directly upon the sand bed. In this case the ties supporting the rails should not be of the usual lightweight pressed steel but of ½″ thick by 5″ wide flats, so as to withstand corrosion. When the track is elevated above the sludge level, it should be supported on steel joists resting on the division walls or on concrete piers. Steel grating between the rails provides the necessary walkway for the sludge car operator.

The narrow-gauge industrial car system may be used for loading sludge directly into auto trucks by bringing the various tracks through curves and switches to a common loading point near the road, and providing a swing loading crane at this point to lift the bucket off of the car and swing it over the road for discharge into the auto truck.

Electric Pumping Plant More Than Pays for Itself

Waycross, Ga., has obtained a new pumping plant for its waterworks, and not only paid nothing for it but is money in pocket by doing so.

The city's supply is derived from driven wells, and is pumped directly into the distribution system, which is connected to a 280,000 gallon stand pipe as an equalizer. The pumping plant consisted of two tandem compound steam-driven pumps and two air compressors, operating air lift in the wells, and two boilers, which were housed in a brick building 55 feet front and 100 feet deep. This plant was less economical than a modern equipment, and it seemed



Box the Compass

And point to activated sludge plants where Norton Porous Mediums are diffusing air

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AND PLATES

NORTON COMPANY
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FROM the Atlantic to the Pacific, from Canada to the Gulf you will find users of Norton Porous Plates and tubes.

The large Ward's Island plant—a unit in the sanitation scheme of New York City — is the latest for which these strong, uniform porous mediums have been selected. Norton Porous Plates are now being prepared for and will be used exclusively in this new and modern plant.

R-305

NORTON PRODUCTS — Grinding Machines; Lapping Machines • Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones • Laboratory Ware, Refractories; Porous Plates • Non-slip Tiles and Aggregates

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Pouring two pipe sections on job in Boro of Richmond, New York City. When using Ex-XL-cell two or more sections may be poured outside the trench, thus saving labor in restricted trench space.

EX-XL-CELL SAVES MONEY, TIME AND LABOR

Ex-XL-cell melts freely, cools rapidly, and sets in a few minutes after the joint is sealed. Two or three joints may be poured outside and lowered into the trench as a unit thereby reducing labor in the restricted space of the trench.

Ex-XL-cell is pliable at all temperatures. It will not run in summer or crack in winter. Strong acids and alkalis in the sewage have no effect on it. Ex-XL-cell is sure and trouble-free. Use it on your next job.

6 Reasons Why

1. Water-tight
2. Root-tight
3. Acid-Proof
4. Indestructible
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6. Flexible

Cochrane Chemical Co.

Industrial Paints, Waterproofing and Insulating Compounds, Expansion Joint Compounds, Cements.

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Ex-XL-cell being used in Union County, New Jersey. Notice the fill at top of picture. When Ex-XL-cell is used, trenches may be back filled as fast as pipe laying progresses as compound sets immediately.

to the city manager, E. V. Bean, that electric driven pumps would be the best solution, especially as the space they would occupy would be so small that room could be found for them in the pumping station without removing the old equipment.

It was estimated (from the pump counters) that the total pumpage was about 417 million gallons in 1929. The pumping station cost that year was $22,166, and was $23,531 in 1928; the full costs for these two years having been $9,133 and $10,037 respectively. The cost of current would be about 1¾ cents per kw.h., and it was estimated that there would be a saving of $5,000 a year in fuel. The electric plant would cost about $12,000, and an arrangement was made for paying for it by annual installments of $2,500 each, the balance of the saving to be used by the city for other purposes.

In 1930 the airlift was replaced with a Byron-Jackson deep-well pump which, with a consumption of 0.375 kw.h., delivers the water into two reservoirs at the pumping station. From these the water is drawn by three Allis-Chalmers single-stage centrifugal pumps; each 1,400 g.p.m. against 140-foot head, direct connected to a 60 hp., 2,200 volt motor. On test, these centrifugals showed an average of .560 kw.h. per thousand gallons singly, and .690 kw.h. pumping two in series.

The electrical plant went into service at the beginning of 1931, and that year the total pumping station cost was $12,299, while it was $18,202 in 1930; the cost per thousand gallons being 3.627 cts. and 5.06 cts. respectively, while additional saving was made by metering, which reduced the consumption about 30.5 million gallons for the year.

The electrical supply is derived over three transmission lines and it is almost impossible that the plants should be without energy at any time.

Test of Paints for Water Tanks

The Pittsburgh Des Moines Steel Company and the Borough of Ambridge, Pennsylvania, who are jointly conducting an extensive test of paints for the interiors of water tanks, have announced the result of the fourth inspection of the 196 paint panels, made January 15, 1932, after one hundred days' exposure.

Following are the average ratings for various groups of paints into which the panels have been classified:

Classification	Average Rating For Class
Red Lead and Linseed Oil Paints	93.3%
Other Linseed Oil Paints	74.3
Synthetic Gum Vehicle Paints	78.0
Pyroxylin Base Paints	56.0
Gilsonite Asphalt Paints	70.5
Coal Tar Paints	86.9
Asphalt Emulsions (Plain)	85.0
Hot Bituminous Coatings	98.9
Thick Plaster Coatings	84.8
Elaterite Paints	89.0
Clear Varnish Finishes	84.2
Aluminum Paints	88.4
Misc. Cold Bituminous Paints	73.8
Asphalt Emulsion and Filler	77.5

	Oct. 15, 1931	Jan. 15, 1932
Average Rating of Unclassified Panels	92.0%	77.3%
Average Rating of All Panels	94.6	79.9

Making a Water-tight Reservoir

In 1930 the Bureau of Sanitary Engineering of Maryland began construction of a 1,000,000-gallon reservoir for the Rosewood State training school. It had been the intention to line embankment and bottom

Honorable A. J. Rossi, Mayor of San Francisco (center), Comptroller L. S. Leavy (left), and Public Administrator A. J. Cleary (right), at inspection of 8-inch cast iron water main installed in San Francisco in 1859 and still in service. The unretouched photograph shows this pipe at bottom of trench.

San Francisco officials honor a cast iron pipe

HERE is a photograph of an earth-incrusted cast iron water main that has been underground for generations. Few objects are more unattractive. Yet to Mayor Rossi of San Francisco this old pipe *looked beautiful.* Why? Because it has saved the taxpayers of his city a great deal of money.

When this pipe was uncovered for inspection in January, it had been in service for 72 years. It is a section of the *first* cast iron pipe laid in San Francisco and is still in service. The longevity of this pipe is remarkable though in older cities cast iron pipe, installed more than a century ago, continues to give satisfactory service.

* * *

During the past year cast iron mains 70 to over 100 years old, and *still in service,* have been uncovered and inspected in large cities throughout America. Mayors and other high officials have personally attended the inspections. Why are these long-lived cast iron mains so honored? Because municipal officials recognize that cast iron pipe is probably the only example of century-old engineering material which is still giving satisfaction under the radically changed conditions of today. Cast iron pipe's long life has saved millions of dollars in taxes and rates.

* * *

The reason for the long life of cast iron pipe is its effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it.

Every taxpayer should take an active interest in the kind of pipe being laid, or to be laid, in his community.

For further information write to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 122 South Michigan Ave., Chicago, Ill.

Cast iron pipe bearing the "Q-check" trademark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Corporation, 11 Broadway, New York.

CAST Q IRON

Look for the "Q-check" symbol as shown above. It is the registered trademark of The Cast Iron Pipe Research Association

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CAST IRON PIPE

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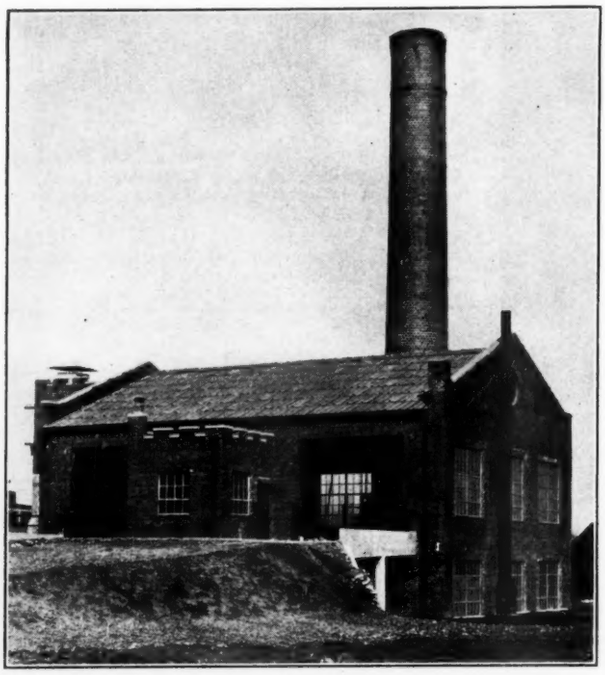
PITTSBURGH DES MOINES



Cleaning Out the Sore Spots

Lakewood, Ohio, has cleaned up its backyard. The community's refuse, garbage and rubbish are now disposed of quickly and economically by scientific incineration.

This "Pittsburgh-Des Moines" incinerator has a capacity of 150 tons per 24 hours. It makes Lakewood a cleaner and healthier place in which to live—without smoke, without odors and at a reasonable disposal cost.

The interior view of the Lakewood furnace below shows the sturdy unit construction and illustrates the ease of stoking and operating a "Pittsburgh-Des Moines" furnace. Only the best refractory materials and proven construction designs are used in the "Pittsburgh-Des Moines."

The "Pittsburgh-Des Moines" catalog gives 24 pages of interesting photographs and valuable disposal costs data on various installations. Write to our nearest office for your copy.

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ATLANTA—CHICAGO—DALLAS—SAN FRANCISCO—SEATTLE

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of the reservoir with riprap, but this plan was changed because of the fact that, during the excavation, a disintegrated mica schist was encountered. As it was evident that a water-tight structure could not be obtained with the riprap lining placed on this kind of material, it was decided to "gunite" the inside of the reservoir. A 2½ inch "gunite" lining reinforced with a single layer of No. 4, 4-inch reinforcing mesh, was applied to the inside of the reservoir. At the top of the slope, the lining was turned down into a trench about 12 inches deep and tied into two rows of reinforcing bars extending around the entire circumference of the reservoir. The "gunite" was applied in one application and the finished surface was left with a natural "gun" finish. The contract was awarded to the Cement Gun Company.

Revenue From Operation of Miami's Incinerator

Miami, Fla., uses the incineration of its refuse for creating steam power. Two boilers are fired by refuse exclusively. One of them furnishes steam for the Jackson Memorial hospital, which is located nearby, for which it receives a revenue of $10,000. The other boiler operates a pumping plant which pumps water into the city mains for the Miami Water Co., for which it received $8,677 during the last fiscal year.

In addition to this, salvaged material brought in $479, and $8,490 was received from two neighboring municipalities for destruction of their refuse. This gives a total revenue of $27,647.

The cost of operation of the incinerator was $100,416, of which $31,257 was for labor, $3,659 for upkeep and repairs, $12,386 for superintendence and other overhead, $51,776 for interest and depreciation and $1,339 for other items. During the year the incinerator burned 63,788 tons of mixed garbage and rubbish; no fuel was used. (The amount was determined by weighing.) This gives a cost of $1.57 a ton, or 76 cents if interest and depreciation be omitted (as it is in the figures for many plants).

For this information we are indebted to A. B. De Wolf, assistant engineer of the Department of Public Service.

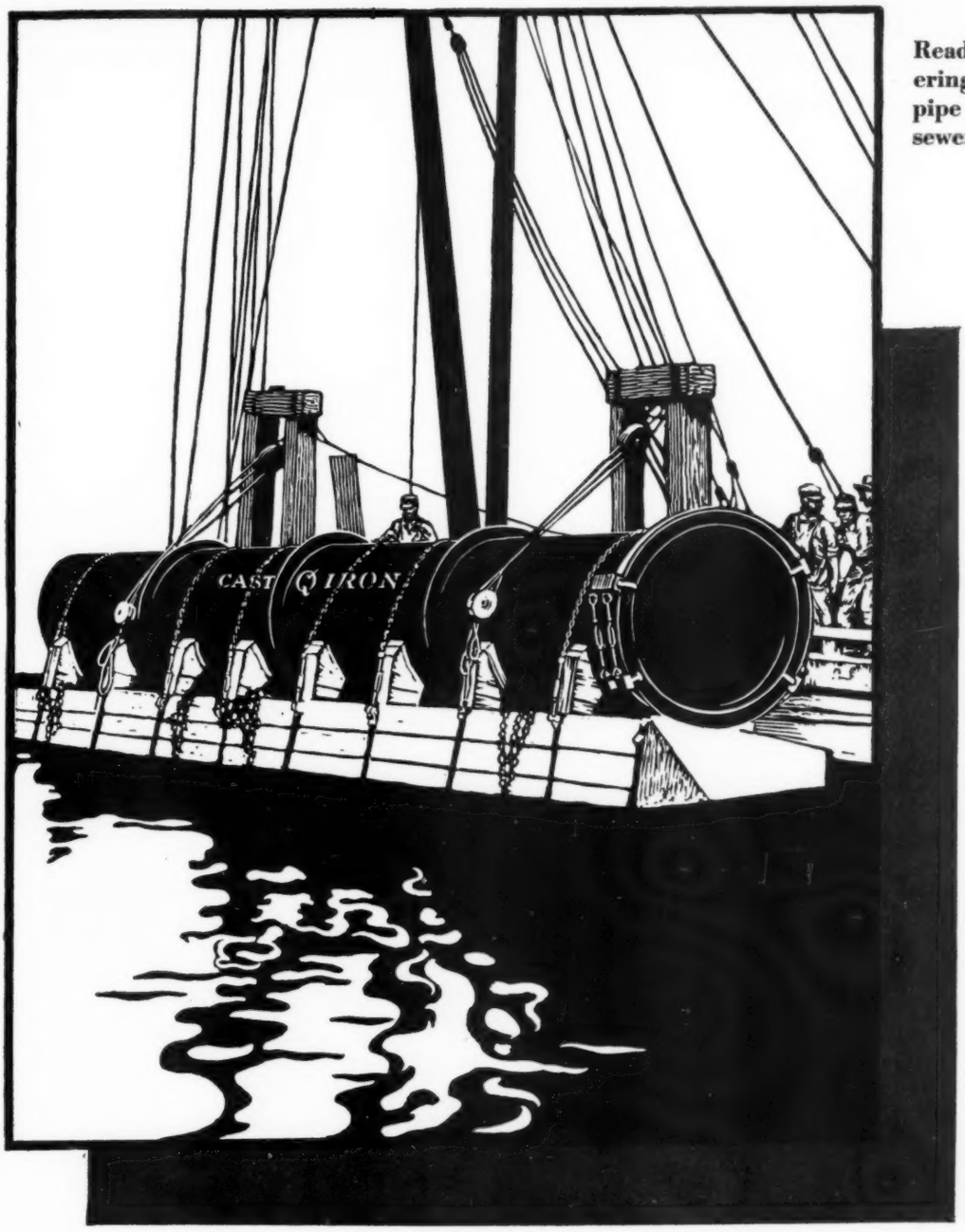
Climatic Treatment of Sewage

The engineer of a town in New Mexico writes us that that town of 10,000 inhabitants built an Imhoff tank about five years ago and a compressed air ejector for lifting the sewage. But the cost of operating the ejector was found to be "prohibitive," and "the benefit derived from the use of the tank without burning the gas was so small" that the town board decided two years ago to discontinue the use of the tank and discharge the sewage untreated into the stream. This stream is dry for the greater part of the year, but the bed is sandy, there are no inhabitants for 18 miles below the outlet, and with "the dry air and sunshine of this climate" there have been no complaints.

Score one more point for New Mexico's climate.

Sewer Rentals Pay for Treatment Plant

An article with this title was published in the March issue, briefly describing the sewage treatment plant of Hanover, Pa., and its system of charging rental for sewer service. We neglected to state that the information was derived from a report of the city manager, C. A. Eckbert, to whom we are indebted for the illustrations also.



Ready for lowering—60-inch pipe for outfall sewer.

Our pipe bears this trademark of The Cast Iron Pipe Research Association.

Above illustration shows method of laying a large submerged sewer outfall main, with the cradle and section of 60-inch U. S. Cast Iron Pipe ready for lowering. For such service, pipe and fittings must be of the best. Cast iron's resistance to corrosion plus permanently tight joints make it the ideal material for sanitary lines under ground or under water, as well as for sewage disposal plants. Our experience in connection with furnishing pipe for such installations is extensive.

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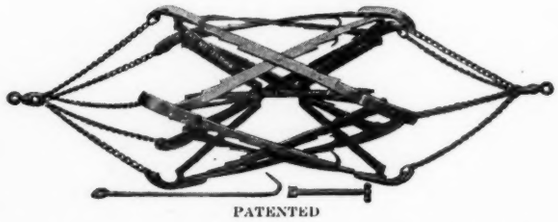
Expanding Root Cutter and Sewer Cleaner



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Will solve this serious problem for your community like it has for others. Give it a trial for 30 days.

It is fitted with five sets of double knives, constructed of spring steel, making some 40 feet of cutting edge, and when drawn back and forth between two manholes by a windlass stationed at each end, the roots are severed by the knives which operate in V-shape formation, like the blades of a pair of scissors.

CITY OF LANSING
State of Michigan
Office of City Engineer

Expanding Sewer Machine Company, Nappanee, Indiana. August 19, 1931.

Gentlemen:

The City of Lansing has been using your Expanding Root Cutter and Sewer Cleaning Method since early last winter and the men in charge of this work have nothing but praise for the equipment. "Just can't see how we ever got along without it" is how the foreman expresses his approval.

Very truly yours,
S. C. JAEKA,
Sanitary Engineer.

HBH/R

COMPLETE SEWER CLEANING EQUIPMENT

Let us know your wants. Write for catalog.

EXPANDING SEWER MACHINE CO.

NAPPANEE, INDIANA

FAIRBANKS

Gate Valves

Taper Seat *Double Wedge*
Bronze Mounted *Bell Ends*

These Iron Body Bell End Gate Valves are tested to 300 lbs. hydraulic pressure when closed to insure perfect performance, and are guaranteed for 150 lbs. water working pressure. They are easily operated and cannot get out of order unless from abuse.

This specification covers our Figures 0406 and 0409, the former being made in accordance with the American Water Works Association Specification.

Write for Complete Catalog No. 20

THE FAIRBANKS COMPANY
BOSTON NEW YORK PITTSBURGH
Factory: Binghamton, N. Y.
DISTRIBUTORS EVERYWHERE

The Water Wheel

(Continued from page 32)

regulations requiring **certification of operators** according to their qualifications[112]. The daily **records of operation** of the water department can be drawn as curves and posted in a useful manner for ready reference[141].

The **per capita quantities** of water pumped in various cities covers a fairly wide range of values[161]. However much more is usually known about these figures than the individual **requirements of houses** of different types[104, 52]. **Friction** in the tees[28] and small pipes is often surprisingly large.

A number of other articles of special interest will be found listed in the bibliography following.

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n35. Hoover Dam Notes, Anon., p. 267.
n36. Banks Come to the Assistance of Hetch Hetchy Project, Anon., p. 267.
Engineering News-Record, Vol. 108, No. 8 (February 25, 1932.)
37. The Radial Cone-Bottom Tank for Elevated Water Storage, Anon., pp. 279-280.
38. Electrical Devices Control Level in New 1.5 Million Gallon Tank, Homer Rupard, p. 281.
39. Municipal Water Tower Designed Against Earthquakes, Alex Lindsay, p. 282.
40. Economies in Dams Designed for Increase in Height, Carlin V. Davis, pp. 292-293.
41. Sealing a Leaking Reservoir in Italian Appenines, B. C. Collier, pp. 293-294.
n42. Bermuda's Water Works System Formally Opened, Anon., p. 300.
n43. Hoover Dam Notes, Anon., p. 300.
Engineering News-Record, Vol. 108, No. 9 (March 3, 1932.)
44. Immense New Water Supply for Paris Authorized, Anon., p. 316.
45. Progress in New Mexico Control of Underground Water Supplies, Anon., p. 325.
n46. Vast Mileage of Pipe Lines Laid in 1931, Anon., p. 325.
47. Knockdown Suction Dredge Clears Reservoir, Anon., pp. 329-330.
n48. New York City's 20 Mile Tunnel Holed Through Anon., p. 334.
n49. Hoover Dam Notes, Anon., p. 335.
n50. Los Angeles to Vote on $34,400,000 Bond Issue, Anon., p. 334.
n51. Hetch Hetchy Employees Accept Bond Payment Plan, Anon., p. 334.
Das Gas und Wasserfach, Vol. 75, No. 1 (January 2, 1932.)
52. Versuche mit Abortspülhähnen und Bemessung der Hausleitungen, Otto Kelting, pp. 7-12.
Das Gas und Wasserfach, Vol. 75, No. 2 (January 9, 1932.)
53. Entkeimung eines Sandfilters, Aug. F. Meyer, pp. 29-30.
Das Gas und Wasserfach, Vol. 75, No. 3 (January 16, 1932.)
54. Entwicklung der städtischen Wasserwerkes Delmenhorst und Betriebserfahrungen mit der Ausfällung des huminsäuren Eisens, Georg Franke, pp. 41-48.
n55. Der practische Brunnenbauer, W. Pangel, 4th Edition, 1932, 553 pages, Published by Laubsch and Everth, Berlin, Reviewed on p. 55.
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56. Selbsttätig Wirkende Pumpwerke in Versorgungsnetzen mit und ohne Hochbehälter, F. Schimrigk, pp. 66-69.
57. Fortschritte in Stahlrohrisollerungen und im Schutz der Rohrverbindungsstillen, Weckwerth, pp. 69-73.
Das Gas und Wasserfach, Vol. 75, No. 5 (January 30, 1932.)
58. Das neue Wasserwerk der Stadt Paderborn, Jos. Lauenstein, pp. 81-87.
n59. Die aktive Kohle, ihre Herstellung und Verwendung, Ergänxungsbund, Oskar Kausch, Published by Wilhelm Knapp, Halle (a S.) 1932, 200 pages. Reviewed on p. 98.
Das Gas und Wasserfach, Vol. 75, No. 6 (February 6, 1932.)
60. Reparaturschweissungen an gusseisernen Strassenarmaturen den öffentlichen Betriebe, H. Jürgen, pp. 108-111.
61. Absperren von Wasserleitungen durch Trockeneis, Otto Scholl, p. 111.
Das Gas und Wasserfach, Vol. 75, No. 7 (February 13, 1932.)
62. Die Wasserversorgung der Stadt Salzburg, und Ihr Ausbau, Rosskothen, pp. 121-126.
63. Rohrinstallation mit Schweissung, W. Johag, pp. 148-151.
n64. The Supply of Water, T. H. P. Veal, London, Chapman and Hall, 1931, 242 pages. Reviewed on pp. 152-153.
Gesundheits Ingenieur, Vol. 55, No. 5 (January 30, 1932.)
65. Ausführungsgrundsätze für die richtige Rohrinstallation öffentlicher Wasserversorgungsnetze, W. Elsner v. Gronow, pp. 55-57.
Gesundheits Ingenieur, Vol. 55, No. 6 (February 6, 1932.)
66. Zur Bestimmung des wirksamen Chlors in Wasser das mit Chloramin behandelt ist, Richard Schmidt, pp. 66-67.
67. Aus der Praxis der Quellen-und Bädertechnik, E. Maurer, pp. 68-69.
Gesundheits Ingenieur, Vol. 55, No. 7 (February 13, 1932.)
68. Wünschelrute und Grundwassererschliessung, G. J. Lehr, pp. 81-83.
Gesundheits Ingenieur, Vol. 55, No. 8 (February 20, 1932.)
69. Zerstörung an Gussrohren der Nürnberger Ursprungsleitung von 1885, Fr. Krauss, pp. 85-89 [Continued in No. 9, pp. 103, 105 (February 27, 1932.)]
n70. Die Arbeitsmethoden der Trinkwasserbiologie, Herbert Beger, Handbuch der biologischen Arbeitsmethoden herausgegeben von von Geh. Med. Rat Prof. Dr. Abderhalden, Abteilung IV, Angewandte chemische und physikalische Methoden, Teil 15, Heft 4, Urban and Schwartzenberg, 1931, Reviewed on p. 96.
Health Briefs (Tennessee), Vol. 6, No. 2 (February 15, 1932.)
n71. Tennessee Streams Are Safe, Editorial, p. 3.
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n72. Typhoid at Rome and Camden, Anon., p. 18.
n73. Crude Methods Used in Bottling Mineral Water, Anon., p. 19.
n74. Typhoid Outbreak at Oswego, Anon., p. 19.
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75. Advertising and Methods of Selling Wells, N. A. McMahon, pp. 8 and 9.
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*76. Solid Matter in Boiler Water Foaming, I. Experiments at Atmospheric Pressure, C. W. Foulk and V. L. Hansley, pp. 277-281.
Johnson National Drillers Journal, Vol. 4, No. 3 (March, 1932.)

(Continued on page 56)

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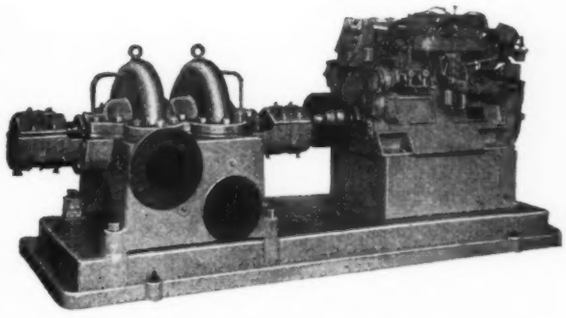

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Bids Wanted:

Streets and Roads

Ill., Urbana— 10 a. m., April 11
For port. cem. conc. pav. 7.6556 mi. Champaign Co.—Bureau of Co. Rds., Co. Supt. Hwys., Champaign Co. Court House.

Ind., Indianapolis— 10 a. m., Apr. 11
For grad. and pav. Illinois St., and 16th St.—Bd. of Pub. Wks.

Ind., Indianapolis— 10 a. m., Apr. 15
Conc., conc. resurfac., brk. resurfac. asph. mac. resurfac., rk. asph. resurfac. 76.630 mi. 13 roads.—State Hwy. Dept., J. J. Brown, Dir.

Ind., New Albany— 2 p. m., May 2
improv. rd. in Georgetown Twp.—Bd. of Comrs., Floyd Co. Court House.

Ia., Ames— 10 a. m., April 12
Grad. 3.210 mi. F-349 Adams Co.; 7.959 mi. F-341—Cass Co.—State Hwy. Comn., Ames.

Ia., Northwood— 1:30 p. m., April 12
Grad. on 18 mi. co. trunk and local co. rds.—Co. Aud., Worth Co. Court House.

Ky., Frankfort— 2 p. m., Apr. 27
Grad. drain. and surfac. 36.5 mi. rds. in 5 counties.—State Hwy. Dept., Div. of Constr.

Md., Baltimore— Apr. 12
Conc. pav. 6.30 mi. Baltimore, Carroll, Queen Anne's and Worcester Cos.; and mac. 1.29 mi. Howard Co.—State Roads Comn., G. Clinton Uhl, Chmn., Federal Reserve Bank Bldg., Balto.

Md., Baltimore— Apr. 13
Conc. pav. 10,000 sq. yds. Pav. Cont. No. 615; and furn. vitr. brk.—Dept of Public Works, Bureau of Hwys., Municipal Bldg.

Mich., Alpena— 11 a. m., Apr. 12
Improv. 3.026 mi. rd. U. S. 23, Proj. F 04-15 C-2, A. L. Burridge, Div. Engr., Cadillac.

Mich., Allegan— 10 a. m., Apr. 13
Grad. widen. 2.866 mi. Allegan Co., Proj. F 03-30-C-1—W. J. Kingscott, Div. Engr., 309 McNair Bldg., Kalamazoo.

Mich., Centerville— 10 a. m., Apr. 13
Grad. and constr. nec. drain. structs. 0.651 mi. on U. S. 112 Proj. F 078-21 C-1, St. Joseph Co.—State Hwy. Dept., Resident Office, 309 McNair Bldg., Kalamazoo.

Mich., Coldwater— 10 a. m., Apr. 8
Grade. widen. 5.609 mi. in Branch Co., Proj. F 012-18 C-1, F. A. 187-D.—H. G. Oakes, Div. Engr., Plymouth.

Mich., Manistee— 10 a. m., Apr. 12
Grad. and shap. rd. also nec. drainage structs. with 2 course gravel. 6.124 mi. M 55. Proj. F 051-7-C-3.—A. L. Burridge, Div. Engr., Cadillac.

Minn., Buffalo— 1:30 p. m., Apr. 11
Grad. 11.76 mi. Jobs No. 3201, 3202 and 3203.—Ernest R. Anderson, Aud., Co. Court House (A. D. Jude, Co. Engr.).

Minn., Cologne— 2 p. m., April 12
For gravel, rd.—L. T. Vos, Town Clk., Dahlgren Twp. Hall.

Minn., Duluth— 10 a. m., April 12
Gravel. Trunk Hwys., 1, 2, 5 and 23, 164.1 mi.—State Hwy. Dept., C. M. Babcock, Comr. of Hwys., 1246 University Ave., St. Paul.

Minn., Faribault— 8 p. m., April 12
For curb and gutter 4th, 5th and 7th Aves. W.—L. E. Zuehlke, Rector, City Hall.

Minn., Fergus Falls— 2 p. m., Apr. 12
Gravel. 3 rds. and grad. 2 rds.—Wm. Lincoln, Co. Aud., Otter Tail Co. Court House.

Minn., Hastings— 2 p. m., Apr. 14
Grad. and gravel. Gas Tax Rd. No. 9, and Gas Tax Rd. No. 4.—County Bd., Court House, Hastings.

Minn., Litchfield— 10 a. m., April 13
Gravel 27.75 mi. 6 road jobs. grad. 32.40 mil. 12 road jobs—J. A. Simonson, Aud., Meeker Co. Court House, (Glen H. Martz, Co. Engr.)

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information regarding it as soon as possible, also corrections of any errors discovered.

Minn., Marshall— 10 a. m., April 15
For gravel. Trunk Hwy. No. 4-6-7-12-17-28-67 and 68, 217.4 mi.—State Hwy. Dept., C. M. Babcock, Comr., 1246 University Ave., St. Paul.

Minn., Preston— 2 p. m., Apr. 20
For grad. 2 mi. Job No. 3220; and 0.6 mi. Job No. 3115; cr. rk. surfac. 18.85 mi. Job No. 3216-S, 3227-S and 3222-S.—F. J. Ibach, Aud., Fillmore Co. Court House.

Minn., Red Wing— 10 a. m., Apr. 19
Gravel. State Aid Rd. No. 20.—C. T. Taylor, Aud., Goodhue Co. Court House.

Minn., St. Paul— 2 p. m., April 12
For grad., and pav. sotuherly part of 8th St.—C. A. Carlson, City Purchas. Agt., 112 City Hall.

Minn., St. Paul— 10 a. m., Apr. 19
Pav. 81.30 mi. 5 state projs., and grad. 48.50 mi. 6 state projs.—State Hwy. Dept., C. M. Babcock, Comr. of Hwys., 1246 University Ave., St. Paul.

Minn., St. Peter— 1:30 p. m., Apr. 19
For grad. and culvts. on 5 mi. 2 routes S. A. R. 15. Jobs No. 2902 and 3201.—W. H. Holz, Aud., Nicollet Co. Court House.

Mo., Jefferson City— 10 a. m., Apr. 8
Oil. earth 24.7 mi. and gravel. 23.5 mi. Div. No. 2; 14.6 mi. gravel, or cr. rk. 14.6 mi. Camden Co. Division No. 5; 84.30 mi. same on co. rds. in Div. 6; 27.8 mi. St. Clair Co. Div. No. 7; 63.60 mi. co. rds. Div. No. 9; and 27.60 mi. co. rds. Div. No. 10.—State Hwy. Comn., T. H. Cutler, Chf. Engr., State Hwy. Bldg.

Mo., St. Louis— Apr. 12
For constr. and improv. sts. Lettings 4389 to 4395, inclusive.—Bd. of Public Service, City Hall.

Mo., St. Louis— Apr. 19
Grad., conc. pav. alleys in 8 City Blks.; est. cost $21,370.—Bd. Pub. Serv., City Hall.

Mont., Helena— May 10
For constr. state projs.—State Hwy. Comsn., R. D. Rader, State Hwy. Engr., Helena.

Neb., Columbus— 2 p. m., Apr. 20
For gravel. approx. 45 mi.—Carl Hoge, Clk., Platte Co. Court House.

N. Y., Boro of Richmond— 12 m., April 13
Regulat., grad. sts. and aves., also constr.. concr. sidewalks on Oder Ave., etc.—John A. Lynch, Pres., Borough Hall, St. George, Staten Island.

N. D., Bismarck— 10 a. m., Apr. 15
For oil mix and pav. 12.083 mi. F. A. Proj. 281-B; and grad. 13.331 mi.—F. A. Proj. 358-D, both Burleigh Co.—State Hwy. Dept., A. D. McKinnon, Chief Hwy. Comsr.

N. D., Fargo— 10 a. m., Apr. 15
For grad. 6.014 mi. etc. F. A. Proj. 267-D, Cass Co.—State Hwy. Dept., A. D. McKinnon, Chief Comsr.

O., Bowling Green— 1:30 p. m., Apr. 11
Grad.. widen. and surfac. treat. rds. Milton Twp., Webster and Troy Twp.—Orton J. Jones, Co. Engr.

O., Wooster— 1 p. m., Apr. 18
Improv. 6 twp. rds.—Co. Comrs., O. G. Leapley, Co. Engr.

Pa., Pittsburgh— 12 M., Apr. 12
For 970 ft. brk. pav. on 8" conc., Evergreen Ave.—Co. Comrs., Robert G. Woodside, Co. Controller.

S. C., Parris Island— Apr. 13
For widen. conc. rds. at Marine Barracks.—Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Tenn., Nashville— Apr. 8
Grad. and drain. 5.891 mi. State Hwy. 35.—State Hwy. Comsn., R. H. Baker, Commr., Nashville.

Vt., Montpelier— 10 a. m., Apr. 8
Conc. pav. 7.6 mi. Lyndon-Burke F. A. Proj. 86C.—Dept. of Hwys., State House, Montpelier.

Wis., Madison— 9 a. m., Apr. 12
Cr. gravel. surfac. var. rds. in Dane Co.—Co. Hwy. Comm., John R. Caldwell, Co. Hwy. Commr., Court House, Madison.

Sewerage and Sanitation

Minn., Worthington— 2 p. m., April 20
Constr. compl. sewage disposal plant.—W. H. Buchan, Clk., (Buell and Winter, Engrs., 504 Insurance Exchange Bldg., Sioux City, Ia.)

N. Y., Brentwood— 2 p. m., Apr. 13
Constr. sews. and water lines at Pilgrim State Hospital, Suffolk Co.; est. cost $146,-857 (former bids rejected).—Dept. of Mental Hygiene, F. W. Parsons, Comr., State Office Bldg., Albany.

N. Y., Long Island City—11 a. m., Apr. 11
Const. sews. catch basins, and appurts. in var. sts. and aves.—Geo. U. Harvey, Pres., Queens Subway Bldg., 21-10 49th Ave., L. I. City.

N. Y, Boro. of Richmond— 12m. April 13
Constr. temporary sani. sew. in Ridgecrest Ave., and sani. sew. in Hylan Ave.—John A. Lynch, Pres., Borough Hall, St. George, Staten Island.

N. Y., West Haverstraw—2 p. m., Apr. 29
Constr. sews. and water lines at New York State Reconstr. Home, Rockland Co.; est. cost $82 138 (note change in date).—Dept. of Health, Thomas Parran, Jr., Comr., State Office Bldg., Albany.

N. Y., White Plains— 2 p. m., May 6
Constr. sect. Q2 Mamaroneck Proj. abt. 1½ mi. 42 and 48" sews.—Westchester Co. Sani. Sew. Comn., Supvrs. Chambers, Court House (W. W. Young, Consult. Engr., Court House Annex.)

O., Columbus— 12 M., Apr. 12
For constr. sewerage and sewage disposal and sewage disposal contr. No. 4A, and 4, Whittier St. storm standby tanks.—Dir. of Pub. Service W. P. Halenkamp.

Wis., Watertown— 2 p. m., Apr. 8
Constr. sew. disposal sys., sani. sews. and pump. sta.—A. H. Stallman, Clk. (E. B. Parson, Consult. Engr., 419 N. Washington St., Watertown.)

Water Supply

Ia., Ottumwa— Apr. 11
Constr. 8 m.g. settling basin, 8 m.g.p.d. filtration plant, 5 m.g.d. clear water well basin, etc.; est. cost $205,000.—F. Vaughn, City Clk., City Hall.

Minn., Little Falls April 14
Constr. watermains exten. at Camp Ripley.—U. S. Property and Disbursing Officer, Camp Ripley, Little Falls.

O., Springfield— 12 M., Apr. 18
Install. sprinkler or irrigation sys.—Bd. of Hospital Commrs., O. O. Hayman, Clk.

Okla., Fort Reno— Apr. 11
Constr. 40 ft. well.—Quartermaster Corps., Reno, Q. M. Depot.

Okla., Pawnee— Apr. 18
Water supply sys. consist. of earthen dam and conc. spillway and 8,000 ft. pipe lines, $200,000 available.—City Engr., City Hall—(W. R. Holway and W. F. McMurry, Engrs., both 302 E. 18th St., Tulsa, Okla.).

S. D., Vermilion— Apr. 11
Constr. 220,000 gal. steel reservoir, incl. 380 ft. 8" c. i. piping with valves, connects.—City Council, City Hall (R. V. Newcomb, City Engr.).

Bridges

Ill., Shelbyville— 10 a. m., Apr. 15
For constr. 1 I-beam br. 19 culvts. Shelby Co.—Co. Supt. of Hwys., Bureau Co. Rds., Shelby Co. Court House.

Md., Baltimore— Apr. 18
Constr. steel and conc. br. approx. 2,200 ft. long, Cont. AA-117-17, Anne Arundel Co.—State Roads Comn., G. Clinton Uhl, Chmn., Federal Reserve Bank Bldg., Baltimore.

Minn., St. Paul— 10 a. m., Apr. 19
Constr. bridges and culvts. on 8 state projs.—State Hwy. Dept., C. M. Babcock, Comr. of Hwys., 1246 University Ave., St. Paul.

N. Y., Albany— 1 p. m., Apr. 8
Constr. Bridges in Madison, Oneida and Steuben Cos.—Dept. of Pub. Wks., Div. of Hwys., A. W. Brandt, Comr. of Hwys., State Office Bldg., Albany.

O., Dayton— 10 a. m., Apr. 16
Constr. rein. conc. slab br. complete Benner Rd. over Old Miami and Erie Canal.—F. A. Kilmber, Clk., Co. Comrs. (W. A. Pease, Co. Engr.).

Pa., New Castle— 2 p. m., Apr. 15
For constr. 2 bridges rein. conc. Mill Race Br.; two steel plate girder spans Neshannock Creek Bridge; est. cost $20,000.—Lawrence Co. Comrs., W. A. Eakin, Chief Clk. (Thos. A. Gilkey, Engr., Greer Bldg.).

Pa., Pittsburgh— 12 M., Apr. 12
Constr. rein. conc. br. rigid frame type over Girty's Run.—Co. Comrs., Robt. G. Woodside, Co. Controller.

Drainage and Irrigation

La., Barksdale Field, Shreveport—Apr. 25
Drainage, sys. for flying field; est. cost $100,000. (Note change in date.)—George E. Lamb, Constr. Q. M.

La., Baton Rouge— 12 M., Apr. 12
For clean. of Bayou Boeuf, Red River, Atchafalaya and Bayou Boeuf Levee Dists., Rapids Parish; Red River, Atchafalaya and Bayou Boeuf Levee Dist. St. Landry Parish, Drain Ditches, Melville So.; Bordelonville West Levee drainage, Red River and Bayou des Glaises Levee and Drain. Dist., Avoyelles Parish.—Bd. of State Engrs., 207 New Orleans Court Bldg., New Orleans.

La., Lake End— 2 p. m., Apr. 27
For improv. drainage in Bayou Pierre, Red River and De Soto Parishes, abt. 500,000 cu. yds. contents.—Bd. of Comrs., of Red River-Bayou Pierre Levee and Drain. Dist., Lake End.

N. J., Trenton— Apr. 19
Dredg. 26,145 cu. yds. overlying matl. and 4,500 cu. yd. ledge rk. in Passaic River.—U. S. Engr., 39 Whitehall St., New York City, N. Y.

O., Avon— Apr. 18
Constr. ditch (Dechant).—Chas. T. Biggs, Co. Engr., Elyria.

O., Delaware— 10 a. m., April 16
Constr. Randal-Howison Tri Co. Ditch in Thompson Twp.—Co. Comrs., J. C. Reichelderfer, Co. Engr.

O., Kenton— 10 a. m., Apr. 9
Constr. Ditch (McMahon) four mi. no. of here.—Perle M. Gebert, Co. Engr.

O., Upper Sandusky— April 23
Constr Ditch (Spring Run) Crawford and Ridge Twps.—Co. Comrs., Wm. F. Hehr, Jr., Co. Engr.

R. I., Providence— 2 p. m., Apr. 20
Dredg. 40,000 to 50,000 cu. yds. matl. in Connecticut River, below Hartford, Conn.—U. S. Engr. Office, Providence.

R. I., Providence— 2 p. m., Apr. 22
Dredg. 96,000 cu. yds. in New Haven Harbor, Conn.—U. S. Engr. Office, Providence, R. I.

S. C., Charleston— 12 M., Apr. 20
Dredg. 31,538 cu. yds. in mouth of Sampit River at head of Winyah Bay, Georgetown, S. C.—War Dept., U. S. Engr. Office.

Wis., Sheboygan— 10 a. m., April 15
Dredg. Sheboygan River.—Bd. Pub. Wks., Fred. Hensel, Pres., (A. L. Boley, City Engr., City Hall.)

Miscellaneous

Ill., Chicago— 11 a. m., Apr. 22
Completion of wk. at Brandon Road Pool, const. conc. masonry walls and sews., Joliet, Ill.—War Dept., U. S. Engr. Office, 333 N. Michigan Ave., Chicago, Ill.

Md., Sharpsburg— 11 a. m., Apr. 12
Constr. rubble stone retain. and guard walls on Aves. and roads Antietam Battlefield.—U. S. Army, Headquarters Third Corps Area, Office of Quartermaster, Baltimore, Md.

Miss., Vicksburg— 10 a. m., Apr. 12
Constr. 8 items of earthwk. ranging from 266,000 to 999,000 cu. yds on East and W. banks of Mississippi River in Mississippi and Arkansas.—U. S. Engr. Office, P. O. Box 667.

Mo., St. Louis— 11 a. m., April 20
Plac. 1,050,000 cu. yds. of earthwork in rebuilding and enlarg. levee of Scott Co. Drainage and Levee Dist., Scott Co., Ill. on Illinois River. U. S. Engr. Office, 428 Customhouse, St. Louis.

N. J., Long Beach— Apr. 12
For reconstr. jetty.—City Council, City Hall.

Tenn., Memphis— 2 p. m., Apr. 21
Constr. 18,761,000 cu. yds. earthwk. on St. John's Bayou Levee and in Lower St. Francis, White River and Upper Yazoo Levee Dists.—U. S. Engr. Office, P. O. Box 97.

Contemplated Work: Streets and Roads

Mich., Crystal Falls—Will soon call for bids for grad. U. S. Hwy. 2, in Wisconsin and Michigan.—Mich. State Hwy. Comsn., J. T. Sharpensteen, Div. Engr., Escanaba.

Minn., Gaylord—Will take bids in April or later for grad. 14 mi. and 30 mi. gravel. 6 or 7 jobs.—Fred Hoppenstedt, Aud., Sibley Co. Court House.

Minn., Luverne—Co. Aud. auth. to adv. for bids for grad. abt. 4 roads.—Ray Koehn, Aud., Rock Co. Court House.

Minn., New Ulm—Will probably call bids in May or June for regravel. 30 to 35 mi. rds.—Louis G. Vogel, Co. Aud., Brown Co. Court House.

Minn., Shakopee—Will take bids in May for grad. 6 mi., and bids in July for gravel. 9 mi.—Thomas H. Walsh, Aud., Scott Co. Court House.

Pa., Pittsburgh—Will call for bids late in April, extend. Mt. Washington Blvd.; est. cost $650,000.—Dept. of Public Works, Edw. G. Lang, Dir.

O., Dayton—Contemp. constr. 8 mi. four-lane hwy. along Mad River from Webster St. & Patterson Blvd. to Wright Field.; est. cost $500,000.—U. S. War Dept., Brig. Genl. H. C. Pratt, Chief of Material Div., Wright Field. Major Genl. B. D. Foulois, Chief of Air Corps,. Washington, D. C.

W. Va., Wheeling—Plans completed ready for bids soon, grad. and drain. Mozard Rd.—T. Y. Beckett, Mayor-Mgr., City Hall.

Sewerage and Sanitation

Ia., Mt. Pleasant—Contemp. reconstr. sewage disposal plant K-line SW of here.—Hall & Co., Engrs., Centerville.

Neb., Lincoln—Work will probably be done this spring for creating Dist. sew. No. 340, 14th nr. Bessie St.—D. L. Erickson, City Engr.

O., Cleveland—Plans soon be completed for extend. sewage treatmt. plant Bulkley Blvd. and Lake Front; est. cost $200,000.—Dept. Public Service, Wm. J. Kennedy. (Geo. Gascoigne, Consult. Engr., Leader Bldg., Cleveland, O.).

Pa., Erie—Plans completed for constr. storm sew. sys. est. cost $60,000.—H. L. Munger, Sts. Dir. (A. N. Aitken, City Engr.).

Water Supply

Mont., Roundup—Making survey. for proposed storage dam Musselshell flood control proj.—B. C. Lillis, Engr., Billings.

N. D., Jamestown—Estimates being made for dam to form swimming pool in Klaus Park.—W. G. Joos, Aud.

Bridges

Mich., Crystal Falls—Will soon call for bids for Constr. br., and constr. overhead crossing S. of Twin Falls power plant.—Mich State Hwy. Comsn., J. T. Sharpensteen, Div. Engr., Escanaba.

Minn., Crookston—Will call for bids soon for constr. Br. across Co. ditch No. 66, 6 mi. W. of Euclid.—Town Bd. of Kertsonville, Fred. La Blanc, Clk.

Minn., Mankato—Probably call bids in May, for br. over LeSueur River, in Decoria Twp.—Claire J. Seift, Co. Engr., Blue Earth Co. Court House.

O., Sidney—Will soon call for bids for constr. br. West Park St.—Co. Comrs., Ed. H. Maurer, Co. Engr.

Wis., Boscobel—Making preliminary surveys for br. across Wisconsin River, No. of here.—State Hwy. Comsn., M. W. Torkelson, State Hwy. Comsn.

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Sealed proposal will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock P. M., advanced standard time, which is twelve o'clock noon, eastern standard time, on Tuesday, April 26, 1932, for the improvement of highways in the following counties:

County	Deposit Required
YATES (One highway: grade crossing Elimination—Gravel—0.30 Mi.)	$450.00
Also for the reconstruction of the following:	
CLINTON (20 ft. Slab Bridge, Bit. Mac. M. M. Optional Approach. 0.23 Mi.)	$1,000.00
ERIE (3 Concrete Boxes, 10 ft. span; 1 Concrete Box, 12 ft. span; 1 Concrete Box, 5 ft.-8½ in. span; 1 Concrete Beam, 28 ft. span. No approach)	1,600.00
ERIE (8 ft. & 19 ft. slabs; 65 ft. & 75 ft. Plate Girders. Bit. Mac. M. M. Optional approach. 1 Mi.)	5,000.00
NIAGARA (30 ft. Concrete Beam: 42 ft. I-Beam Bit. Mac. M. M. Optional & Grading approaches. 0.32 Mi.)	1,600.00
SULLIVAN (Concrete—Highway—3.00 Mi.)	5,500.00

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

A. W. BRANDT
Commissioner of Highways

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DIVISION OF HIGHWAYS
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County	Deposit Required
DUTCHESS (One highway: 2.28 Mi.)	$ 6,000.00
QUEENS (Two highways: 0.87 & 0.47 Mi.)	$12,000.00 & 15,000.00
NASSAU (One highway: 3.33 Mi.)	17,000.00
Also for the reconstruction of the following:	
MADISON (Bridge contract: 0.03 Mi.)	$ 1,200.00
ONEIDA (Bridge contracts: 0.27 & 0.15 Mi.)	$3,000.00 & 2,000.00
STEUBEN (Bridge contract: 0.55 Mi.)	5,000.00

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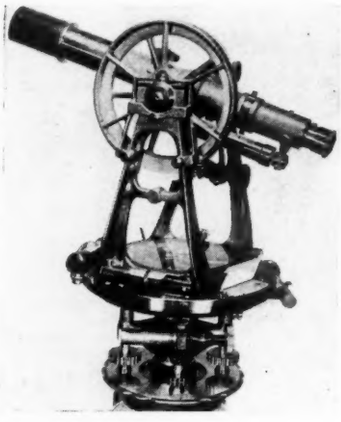

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Journal of the American Water Works Association, Vol. 24, No. 2 (February, 1932.)
79. Minimum Flow of North Carolina Streams, Charles E. Ray, Jr., pp. 171-203.
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Journal of Bacteriology, Vol. 23, No. 2 (February, 1932.)
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92. Averaging Bacterial Counts, A. H. Robertson, pp. 123-134.
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Journal of the New England Water Works Association, Vol. 45, No. 4 (December, 1931.)
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98. Water Filtration at Hartford, W. A. Gentner, pp. 360-371.

Journal of the Western Society of Engineers, Vol. 37, No. 1 (February, 1932.)
99. Effects of the Drought in 1930, C. R. Knowles, pp. 47-51.

The Military Engineer, Vol. 24, No. 134 (March-April, 1932.)
100. The Colorado River Aqueduct, Julian Hinds, pp. 115-119.

Municipal Sanitation, Vol. 3, No. 3 (March, 1932.)
101. Cooperative Efforts of Cities and Plants Aid in Controlling River Pollution, Editorial, pp. 107-108 and 117.

National Safety News, Vol. 25, No. 3 (March, 1932.)
102. Safety Progress on the Hetch Hetchy Aqueduct, S. M. Jarrett, pp. 21-22 and 65.
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Plumbing and Heating Contractors Trade Journal, Vol. 92, No. 9 (February 15, 1932.)
104. Foolproof Water Supply Plan Safeguards Plumbing Profits (To be concluded), T. F. Moffett, pp. 45-46.

Power, Vol. 75, No. 7 (February 16, 1932.)
105. Uses for Sodium Aluminate, J. A. Holmes, pp. 241-242.

Power, Vol. 75, No. 9 (March 1, 1932.)
106. The Fundamentals of Boiler Blowdown, W. J. Ryan, pp. 325-328.

Power Plant Engineering, Vol. 36, No. 5 (March 1, 1932.)
n107. Test-O-Meter for Boiler Water, Anon., p. 229.

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Public Health News (New Jersey), Vol. 17, No. 3 and 4 (February-March, 1932.)
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Science (Supplement), Vol. 75, No. 1941 (March 11, 1932.)
n115. New Type of Filter, Anon., p. 12.

Scientific American, Vol. 146, No. 3 (March, 1932.)
116. A Horizontal Well Supplies Fresh Water at Bermuda, Anon., p. 153.

Surveyor, Vol. 81, No. 2089 (February 5, 1932.)
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n108. A Practical Handbook of Water Supply, Frank Dixey, Thomas Murby and Co., London, 1931. Reviewed on p. 203.
n119. Cast Iron Pipe Manufacture: Oldham Firm's Enterprise, Anon., p. 208.

Surveyor, Vol. 81, No. 2090 (February 12, 1932.)

120. The Rangoon Water Supply: The Hlawga Low Level Lake Scheme, Anon., p. 236.

La Technique Sanitaire et Municipale, Vol. 26, No. 12 (December, 1931.)

121. Etude sur le réfroidissement des eaux destinées à alimentation, F. Diénert, pp. 451-456.

The U. S. Piper, Vol. 5, No. 1 (March, 1932.)

122. The Community Water Service Company Installs Seven Miles of Cast Iron Pipe at Lexington, Ky., for Stand-By Service, Anon., pp. 1-4.

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University of Iowa Studies in Natural History, Vol. 13, No. 6 (July 1, 1931), New Series No. 206.

125. Iowa Algae, Gerald W. Prescott, pp. 1-235.

Water and Water Engineering, Vol. 34, No. 400 (February 20, 1932.)

126. Water Pollution Research, Editorial, pp. 51-52.

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n138. A Practical Handbook of Water Supply, Frank Dixey, Thomas Murby and Co., London, 1931, 571 pages. Reviewed on p. 90.

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139. Filter Sand Studies, John R. Baylis, pp. 43-46.

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Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, Abteilung I, Vol. 124, Nos. 1 and 2 (February 25, 1932.)

169. Ueber Nachweis und Bewertung des Bact. coli in Trinkwasser, J. E. Minkewitsch, pp. 61-63.

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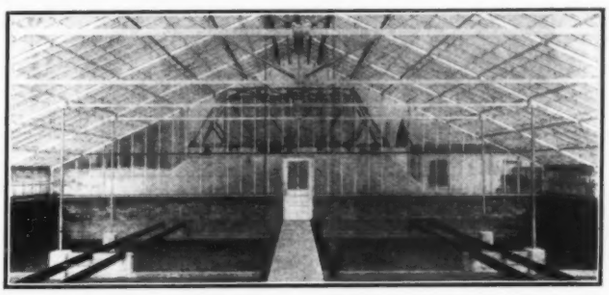

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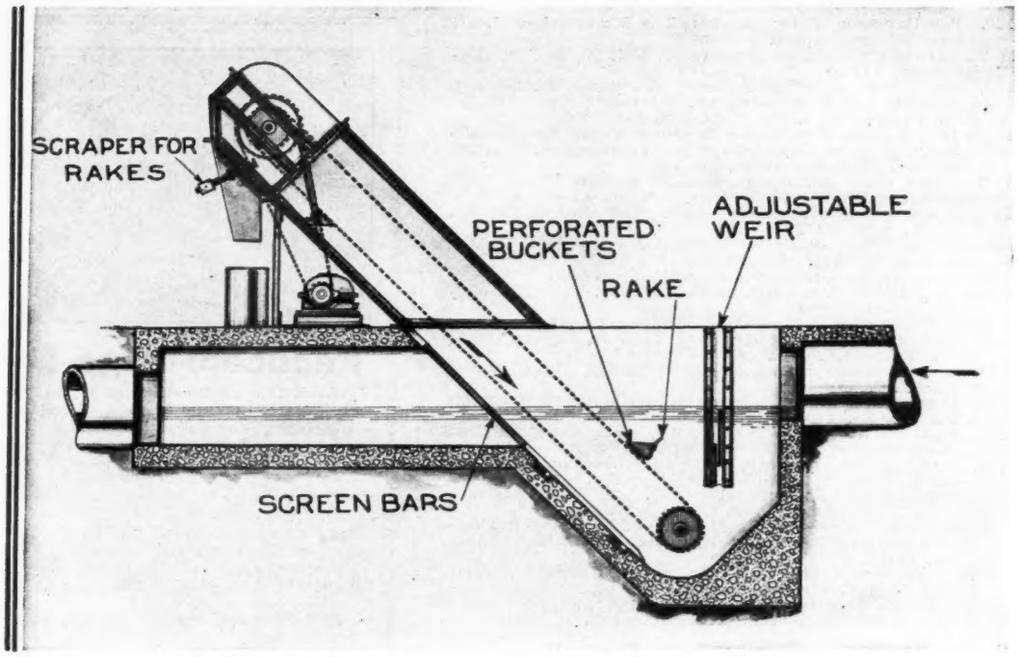

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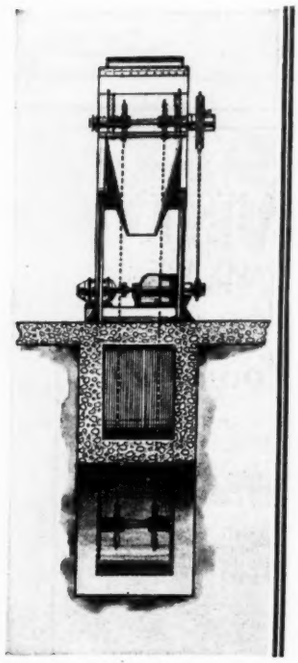

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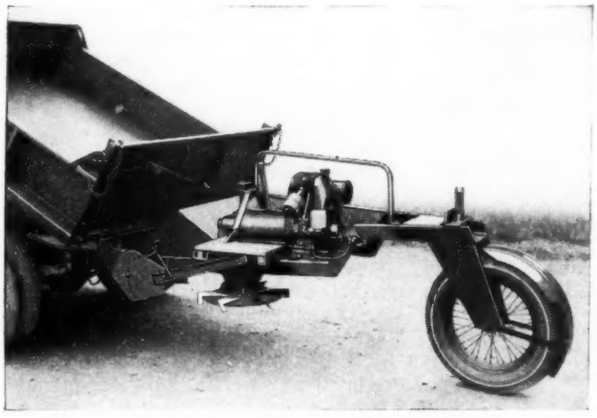
New Roadbuilding Equipment

Ditwiler Material Spreader

The Hercules-Ditwiler Trailer Type Spreader now being made by the Ditwiler Manufacturing Company of Galion, Ohio, is adapted for spreading chloride for dust prevention, for spreading salt, sand, cinders or chloride on icy streets, for spreading chips, slag, or other covering on penetrated stone—and in fact for any spreading of light aggregates 1″ or smaller on roads; in construction or maintenance. It will also spread ground lime or fertilizer on fields or grass plots.

The spreader is operated by its own air-cooled motor and width of spread, 6 to 30 feet, is regulated by the speed of the motor and is always uniform regardless of the speed of the truck.

The Hercules-Ditwiler Spreader is designed especially for use with lighter dump trucks, but by a simple adjustment it can be used just as readily with larger trucks.



Hercules-Ditwiler Material Spreader

Agitator blades in the feed hopper give the material a rotary motion and break up lumps which may have formed. An additional hopper is supplied for use in spreading chloride from non-dumping truck bodies.

This spreader requires only a small permanent attachment on trucks being used and it can be attached to each truck in turn in less than a minute. Adjustable legs are used to support the front of the spreader when detached.

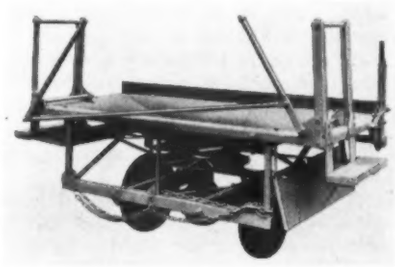
The weight of this spreader, engine, hoppers and all, is 535 pounds. In operation this weight is supported in part by the truck and in part by the rear wheel on a standard auto tire. The spreader trails back and manipulates perfectly at all truck speeds, in operation or in moving from place to place.

The Universal Differential Disc Spreader

The Differential Disc Spreader is a new material spreading device for use by macadam road builders, resurfacing contractors, states, counties and cities, recently announced by The Universal Crane Co., Lorain, Ohio.

The distribution of the material is by means of dropping the material onto a disc revolving in a horizontal plane. The power for revolving the disc is obtained through the traction on the ground of the two wheels supporting the spreader. These wheels are equipped with industrial size (6″ x 9″) pneumatic balloon tires and drive back through a standard automotive type of 4-pinion differential to the vertical shaft on which the distributing disc is mounted.

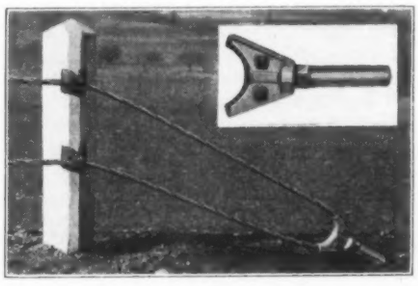
A major advantage claimed for this type of drive is its ability to spread dust and screenings as a binder on the first and second courses of large stone. It is also claimed that the differential action, which compensates for difference in wheel speeds on curves, gives a spreading efficiency on curves and intersections equal to that on straightaway. Density of spread is dependent on variable gate openings.



The Differential Disc Spreader

New Guardrail Fittings

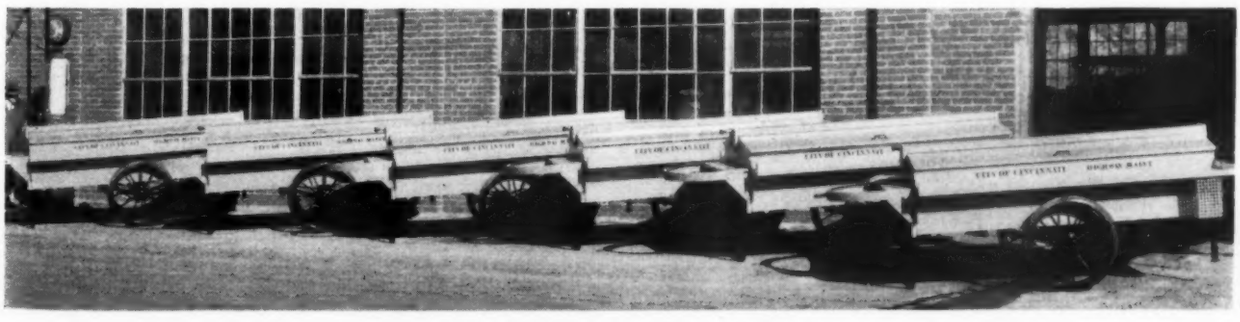
A new and complete line of malleable iron fittings for a highway guardrails has been brought out by Joseph H. Ramsey, 11 North Pearl St., Albany, N. Y. A device for adjustably securing the cables to the anchor rods at the ends of spans is shown in the illustration. Other new items in the line include malleable iron guardrail posts, off-set brackets, turnbuckles, cable splices, anchors, anchor rods, etc.



Ramsey Guardrail Fittings

Portable Tool Boxes in Cincinnati

Cincinnati has recently added six portable tool boxes, making a total of 22 in use. This is in accord with the policy of that city to eliminate stationary boxes for storage and safe-keeping of tools. It was found that a stationary tool box full of tools was often so heavy that it had to be unloaded



A Fleet of Portable Tool Boxes Used in Cincinnati

before the men available could lift it onto a truck.

Portable tool boxes, which are of the Han Dee Box type, manufactured by Littleford Bros., Cincinnati, are kept completely equipped and ready for use. Then, in an emergency, a truck operator can hitch to one or more of them himself. Frequently a truck will start out with as many as three of these portable boxes in tow, drop them at the desired locations, and proceed. The body of the truck is also left free for other purposes.

These portable boxes afford complete protection to tools, and can be left on the job all night without a watchman.

A Mechanical Chip Spreader With Agitator

A mechanical chip spreader with a road wheel which operates a spiral agitator running across the body of the unit, and which may be attached to a motor truck in one minute, has been placed on the market by the Adnun Engeering & Manufacturing Company, Nunda, N. Y.

The spreader is effective whether the truck is moving forward or in reverse, adjustment for change being made by throwing an auxiliary lever. The width of the spread is adjustable from 6 inches to 9 feet. The amount of discharge is regulated by a sliding gate, controlled by a lever. The N & H mechanical spreader will spread sand, gravel, calcium chloride, crushed stone or slag with equal effectiveness.

A High Speed Spreader

The G. S. C. Hi-Speed Spreader is a development that makes it possible to distribute gravel, stone, sand, cinders and calcium chloride on roads in an efficient economical manner and at high speed if desired. It is manufactured by the Efficient Road Machinery Co., Syracuse, N. Y.

This unit can handle any size of material up to No. 3 crushed stone. The depth of spread can be controlled to range from a light sprinkle to a layer several inches deep. The width of spread ranges from 1 to 8 feet as desired. It fits any truck without using special adapters or boring a single hole. It can be comp'etely attached or detached by one man in fifteen minutes. It operates with equal efficacy at either the maximum or minimum speed of the truck on which it is mounted. It interferes in no way with the operation or capacity of the truck.

New Gas Engine Concrete Bump Grinder

The Mall Tool Company, Chicago, Ill., has brought out a 3 H.P. concrete bump grinder. Its design embodies engineering features which have been the result of much research and development directed towards the

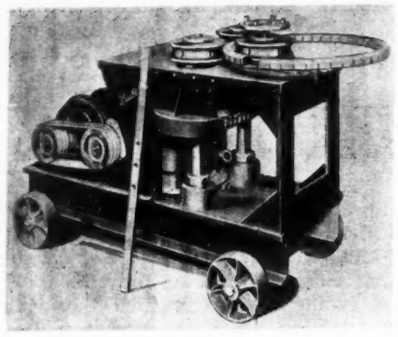
The Mall Gas Driven Concrete Bump Grinder.

contractors' finishing requirements, the result being that this new machine is extremely light in weight so as to permit easy handling at all times, yet develops over 5 h.p. maximum and operates at sufficient high speed so that when grinding, a very coarse cup wheel can be used without chipping the pebbles and aggregate, producing a very smooth surface.

Simplex Reinforcement Bending Roll

A new bending roll, designed for the bending of 1¼" corrugated reinforcing bars used in concrete construction has recently been developed by the Buffalo Forge Co., Buffalo, N. Y.

This machine saves large amounts where reinforcing bars are bent for concrete smokestacks, pipe, tunnels, bridges and culverts. With the new



This Simple Bending Roll will handle bars up to 1¼-inch.

bender, material up to 1½"-inch is formed at the rate of 70 feet per minute with 5 h. p. motor or 7½ h. p. gasoline engine. On most types of work, only one operator is required. The diameter range is from 20 inches up.

Sani-Tite—A Sewer Joint Compound

The Hydraulic Development Corporation, 50 Church St., New York, N. Y., manufacturers of Hydro-Tite, are now ready to make shipments of Sani-Tite, a new bituminous joint compound for sewer pipe.

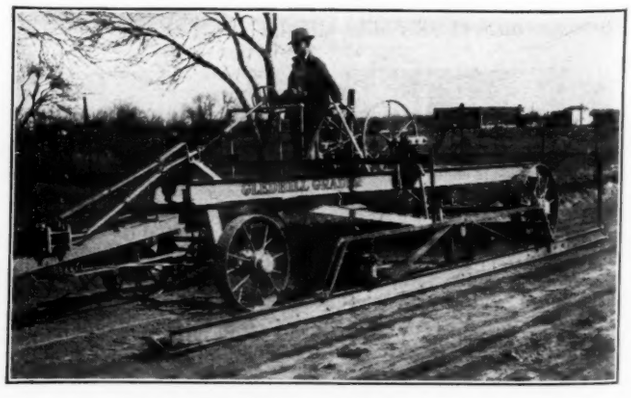
Sani-Tite is put up in 300 and 400 lb. drums. It is easy to melt and pour. Many points of superiority over ordinary sewer compounds are claimed for it.

Gledhill Adjuster Now Complete Unit

The Gledhill Road Adjuster announced last year as an attachment for drawn or motor graders is now available also with its own chassis as a complete unit. This Adjuster has proven very effective in adjusting black-top and other forms of macadam as well as earth roads to a practically perfect level or to any desired crown.

The distinctive feature of this Adjuster are the long straight-edge and the spirit level. The straight-edge keeps the adjusting blades running true without being affected by minor irregularities in the road, while the spirit level guides the operator in "setting" the blades to produce the crown desired.

The G S C Hi-Speed Spreader



The Gledhill Road Adjuster

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★ *It is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Bituminous Road Paver

25. Specifications and description of new Paver that gathers, proportions, mixes, spreads and compacts bituminous road in one continuous operation offered by Barber-Greene Co., 635 West Park Ave., Aurora, Ill. Ask for Bulletin BPF.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Handling

40. Pouring concrete with portable and permanent belt conveyors on bridges, dams, buildings, locks, sewers, tunnels, etc., is described in a generously illustrated booklet, "CONCRETE HANDLING," by Barber-Greene Co., 635 West Park Ave., Aurora, Ill.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry. Mfg. Co., Columbus, Ohio.

Excavating Buckets

73. Excavating Buckets — shows the various types and sizes, the uses for which they are intended, construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Finishing Machines and Screeds

75. High Speed Screeding and Finishing—the use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages. The Lakewood Engineering Company, Columbus, Ohio.

Graders

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

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Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

107. "Operating Records for Motor Trucks" is one of the most complete record books available. It includes the necessary forms and directions for a very accurate and detailed accounting of Motor Truck operations. Dodge Brothers Corp., Detroit, Mich.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Gallon Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

151. Lifting capacities and working ranges for the different sizes and types of the complete line of ½-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers. Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

201. Full data on tar and asphalt kettles, oil burning kettles, pouring pots, torches and hand spraying attachments. Connery & Company, Inc., of Philadelphia.

205. The latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

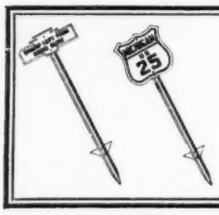
211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E.



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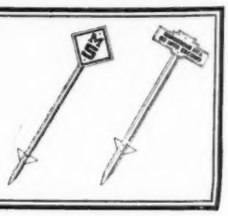
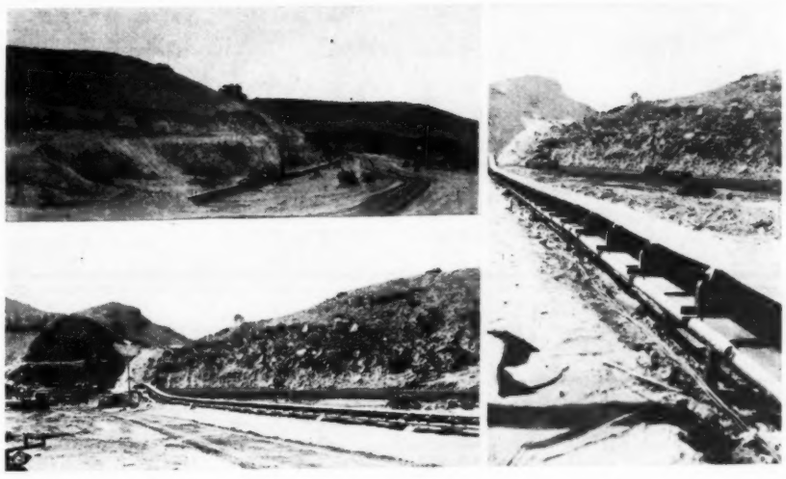
Made in our own rollingmills from Special high Carbon steel—

Strong, durable,—pleasing in appearance. *Write for descriptive folder.*

Sweet's Steel Company, Williamsport, Penna.



Belt Conveyor System handling 15,000 to 18,000 cu. yds. of earth per day with two shifts on the Serrano-Carpenter Irrigation project for Orange County, Calif. R. G. Le Tourneau, Inc., contractors. Link-Belt equipment is used.

A Fleet of FWD Trucks recently ordered by the New York State Highway Department

New Federal 6-Wheel Dual Drive Truck

Following the introduction of the single drive 3-ton six-wheeler over a year ago, the Federal Motor Truck Company of Detroit now presents a dual drive six-wheeler, with six-wheel hydraulic brakes, of the same capacity, available in four and six-cylinder engines at $1350 and $1450 respectively for standard chassis f. o. b. Detroit. The four-cylinder model is supplied in 140″ and 164″ wheelbases. The six-cylinder chassis in 145″ and 169″ wheelbases.

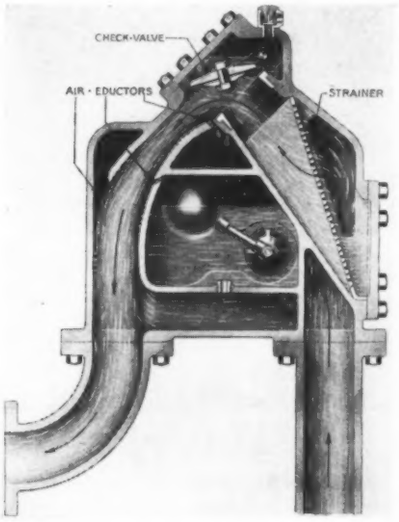
This new Federal is built as a complete transportation unit, with the dual drive, six-wheel feature designed and engineered into the chassis as an integral part of the vehicle.

Federal Truck 6-wheel chassis

Suction Line Primer for Centrifugal Pumps

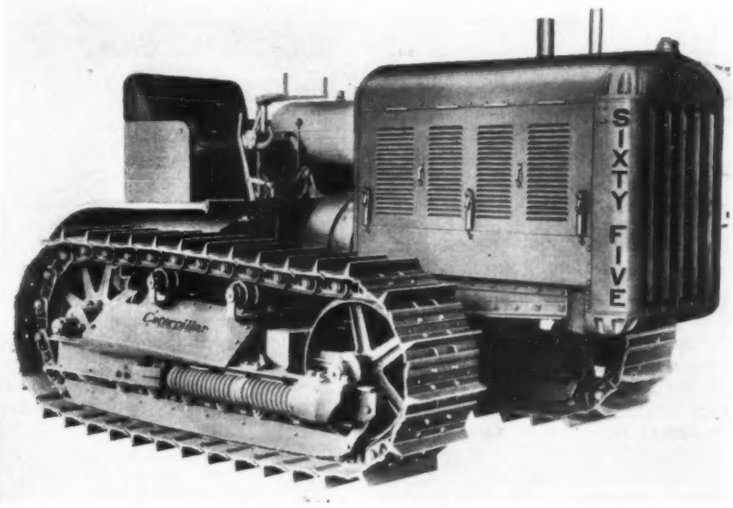
A new priming device for centrifugal pumps has been announced by Barrett, Haentjens & Company, Hazleton, Penna.

The device combines in one compact casting a check valve, strainer, and air removing device. It is built in various sizes, for a maximum capacity of 1500 G.P.M. and a maximum operating head of 200 ft. When furnished with a special control panel, it makes possible automatic operation of the pump with complete protection against loss of water, air leaks, break of the column line, etc.



The Barrett, Haentjens Suction line primer as operating.

Bulletin, No. 530, describing this primer will be sent upon request to those interested.



The Caterpillar Sixty-five, the newest and largest Caterpillar, develops 85 maximum brake horsepower. It takes the place of the famous "Sixty" known and used all over the world.

Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditons. Caterpillar Tractor Co., Peoria, Ill.

Highway Maintenance

219. "Tarmac C P (Cold Patch)." Valuable information concerning the varied uses and methods of application of cold mix for repairs and surfacing, together with many actual photographs. Koppers Products Company, Koppers Building, Pittsburgh, Pa.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.,

Road and Paving Materials

Bituminous Materials

226. "Mixed - in - Place Construction." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road wth "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Surfacing with Tarmac." A concise booklet describing methods and advantages of using Tarmac in prime coating, surface treatments, re-treatment, penetration, mixed-in-place, etc. Koppers Products Company, Koppers Building, Pittsburgh, Pa.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types o fsnow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. Complete data for selecting the proper size snow plow for your particular make and model of truck. Carl H. Frink, Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Incinerators

396. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa. Booklet on request.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. "Data Book"—Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

407. "Handbook of Cast Iron Pipe" contains useful tables and data for the Water Works man on pipe line construction, weights and dimensions. U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

425. Folder, standard filling size, contains model set of specifications and 11 x 17 inch drawings showing standard sizes and construction details of King Glass Enclosures for sewage treatment plants. King Construction Co., 539 Wheatfield St., North Tonawanda, N. Y.

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Sewer Maintenance

428. "The Expanding Root Cutter and Sewer Cleaning Method," a 32-page booklet prepared by the Expanding Sewer Machine Co., Nappanee, Ind., gives full details as to methods and equipment needed for sewer cleaning.

Sludge Treatment

430. Downes Floating Covers and Sludge Digestion Equipment. The Pacific Flush Tank Co., 136 Liberty St., New York, N. Y. Contains photographs of installations of floating covers and technical data on the subject.

Treatment

432. Eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. The Pacific Flush Tank Company of Chicago and New York.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Valves

436. Data Book on Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

NEWS FROM THE FIELD

Announcement has been made by W. McK. White, President of the Chausse Oil Burner Company of Elkhart, Indiana, that the business of the Chausse Company, after March 1, 1932, will be conducted by the White Manufacturing Company, also of Elkhart, Indiana.

Development of a complete new line of bituminous road building machinery by White Manufacturing Company engineers, influences the decision to market this equipment hereafter as Chausse-White products. These consist of bituminous paving mixers for both hot and cold laying, rotating aggregate dryers, and complete premixing plants, in addition to the Chausse street repair machines, tar kettles and kerosene torches.

The Chausee Oil Burner Company was formed in 1923 by Mr. White and

W. McK. White

his brother, Wray P. White, and W. G. Chausse, in Detroit, Michigan, to market portable street repair equipment, tar kettles and torches. The following year the Chausse Company was moved to the plant of the White Manufacturing Company which has produced the Chausse equipment. Messrs. Chausse and W. P. White remain directors of the Chausse Company but have not been active with the concern for several years.

There will be no change in sales representation through a large number of prominent equipment dealers throughout the United States and Canada as these distributors will continue to market Chausse-White products.

The Galion Iron Works & Manufacturing Company, Galion, Ohio, has announced the appointment of the K. B. Noble Company of Hartford, Connecticut, as its authorized distributor for the entire state of Connecticut and the western part of Massachusetts. K. B. Noble, president of the K. B. Noble Company, is well known to Connecticut and Massachusetts road builders, having been in business for the past twenty-five years.

C. L. McMullen, formerly of Madison, Wisconsin, and well known in the Industrial Engine field has recently joined the Caterpillar Tractor Co. organization at Peoria, Ill.

The Superior Construction Equipment Company, Chicago distributors of the Byers Machine Co., Ravenna, O., have opened a branch office in Indianapolis. R. D. Abrell has been appointed district manager.

At a special meeting of the Board of Directors of the Keystone Driller Company of Beaver Falls, Penna., the following officers were elected: President, L. M. Johnston of Pittsburgh, formerly Vice President of A. M. Byers Company; Vice President, E. C. Rebeske, President of First National Bank of Beaver Falls, formerly Treasurer of the Union Drawn Steel Co.; Secretary, R. R. Downie, re-elected; Treasurer, C. T. Smith, re-elected.

Barber-Greene Co., Aurora, Ill., has appointed Boehck Equipment Co., 2404 W. Clybourn St., Milwaukee, Wisc., as Wisconsin representatives for Sales and Service.

The Sullivan Company of Memphis, Tennessee, manufacturers of Konset, Seacote and other waterproofing products, announce a new engineering service available to their trade, stating that they maintain an Engineering Department at their general office at Memphis, Tennessee, for the purpose of writing a specification to cover each and every job.

The Lock Joint Pipe Company has announced an arrangement with the American Concrete & Steel Pipe Company, of Los Angeles, California, whereby the American Company will manufacture and install Lock Joint Steel Cylinder Reinforced Concrete Pipe west of the Rocky Mountains and in Texas.

The Byers Machine Company, Ravenna, O., announces that the W. T. Walsh Equipment Company, Cleveland, and the Boehck Equipment Company, Milwaukee, have been added to their distributor organization.

D. D. Barnes, formerly Sales Manager for the Smith Engineering Works, has joined the H. O. Penn Machinery Co., East River and 140th St., New York City, who represent Byers Cranes, Rex Mixers and Hotchkiss Road Forms.

Guy H. Billings, who has been appointed Assistant General Manager of the Four Wheel Drive Auto Co., Clintonville, Wisc.

Recent Publications

Asphalt Road Construction.—The Asphalt Institute, New York, has begun the publication of a series of intensely practical pamphlets for the road builder. These are designed to tell the highway engineer or official exactly "how" and "why." The first of these manuals just issued covers "Road-Mix Types." There are 10 illustrations in the 59 pages. Among the chapter headings are *Selection of Appropriate Type; Labor Equipment and Tools; Constructing Wearing Course; Material Tests and Control of Mixtures; Service and Cost.*

Swimming Pools and Bathing Beaches.—A bulletin on "The Operation of Swimming Pools and Bathing Beaches" prepared by engineers of the Division of Sanitation has been issued by the New York State Department of Health. It consists of 36 pages, including full-page diagrams of typical designs and a suggested form for reporting on swimming pool operation. The provisions of the Sanitary Code in regard to swimming pools and of the Public Health Law relating to bathing places are printed in the back of the bulletin.

Rural Water Supply and Sewage Disposal.—A 50-page booklet on this subject has been issued by the New York State Department of Health. Part I is devoted to rural water supply, covering ground and surface supplies; pumps, rams, etc.; the treatment of water by boiling, disinfection and filtration; the care of water supply equipment, and water analyses. Part II, covering sewage disposal, discusses small septic tanks, subsurface disposal systems, sand filters and cesspools. The final 8 pages are devoted to the various toilet types.

Water Storage

442. "Modern Water Storage" contains 28 pages of reliable information, interesting photographs, authentic engineering data and "Pittsburgh-Des Moines" specifications on various types of elevated tanks, penstocks, pipe lines, stand pipes, steel reservoirs, treating plants and complete water systems.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., Peoria, Ill.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125, Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules, General Catalog No. 11.

Transits and Levels

629. A booklet giving full information on the sizes and styles of Berger Transits and Levels will be sent promptly by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co. 136 No. 12th St. Philadelphia, Pa.

LATEST PUBLICATIONS

714-722 are the latest publications received and have not been described in this section before.

Palatable Drinking Water

714. A publication covering taste and odor removal with activated carbon telling of experiences in many plants under varied conditions has been issued by Industrial Chemical Sales Co., Inc., 230 Park Ave., New York City.

Pumps

715. The latest developments in screw pumps are described in a new bulletin (No. 145) which has been issued by Morris Machine Works, Baldwinsville, N. Y. Where large volumes of water are to be pumped against low heads and electric motor drive is desired, this special design is said to be superior to standard centrifugal pump types because of its higher speed characteristic which provides greater efficiencies at speeds suitable for motor drive. These pumps are particularly suited for sewage, storm water, drainage, etc., as the large propeller passages will handle refuse, silt, stone, etc., without clogging. The bulletin describes the characteristics and gives performance tables and curves showing operating characteristics.

Road and Street Maintenance

716. Caterpillar Tractor Co., Peoria, Ill., has issued a new folder illustrating the use of their equipment.

Moto-Mixers and Agitators

717. An elaborate booklet, No. 211, of 40 pages, which illustrates and describes in detail ready-mix concrete plants of (1) the dry plant (2) the wet plant (3) the shrink plant, has been issued by the Chain-Belt Co., Milwaukee, Wis.

Tarvia

718. The Barrett Co., 40 Rector St., New York City, has just brought out a new 32 page book on road construction and maintenance with Tarvia.

Highway Guard Rails

719. Designs and fittings for highway guard rails are fully described and illustrated in Catalog No. 32, 28 pages, issued by Joseph H. Ramsey, 11 No. Pearl St., Albany, N. Y.

Finishing Machine

720. The use of finishing machines for both bituminous and concrete surfacing is fully described. Typical form set ups are illustrated and valuable information given. Bulletin 47-E, Lakewood Engineering Co., Columbus, Ohio.

Industrial Power

721. A 32 page booklet "Push-Pull-Haul-Hoist," covering applications of McCormick-Deering industrial power, has been published by International Harvester Co. of America, Chicago, Ill.

Speed Trucks

722. Illustrations and descriptions of International Speed Trucks in capacities ¾ to 3-ton, suitable for various types of construction and hauling.

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When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 63 and order by number.